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GAS Journal

LIGHT·HEAT·POWER·BYE-PRODUCTS

Vol. 204. 85th Year. LONDON, NOVEMBER 22, 1933. No. 3679. Price 1s.

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Gas Purification & Chemical Co.
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NO POT STILL
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PLANT WORKING THERMOSTATICALLY AT WELLINGBORO'

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Purifying Material from STOCK.
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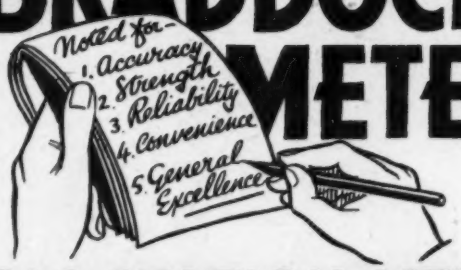

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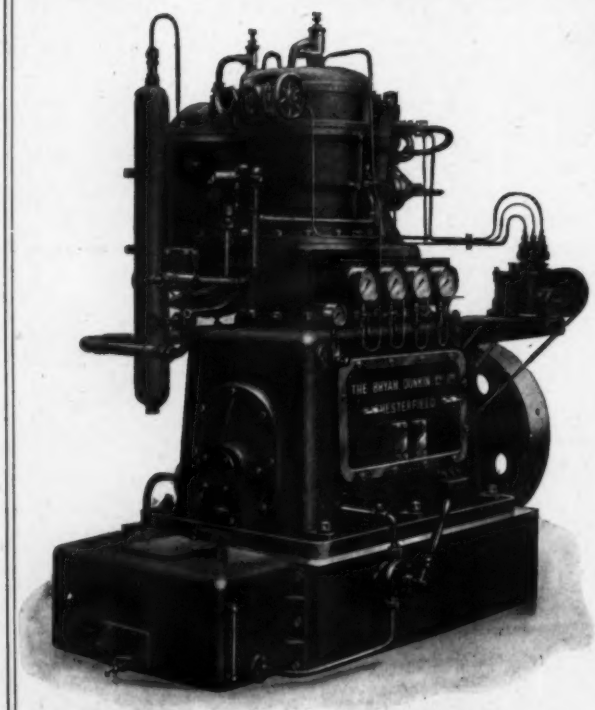

We are making these Compressors for filling cylinders with gas for gas-driven motor vehicles.

for pressures up to 5,000 lbs.— Town's gas or Coke Oven gas

The compressor illustrated is a Four-stage machine capable of supplying 100 cu. ft. of free gas per minute when running at about 480 r.p.m.

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Forced Lubrication Throughout.

Gas efficiently Cooled after each stage.

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[Founded in 1849 as the "Journal of Gas Lighting."]

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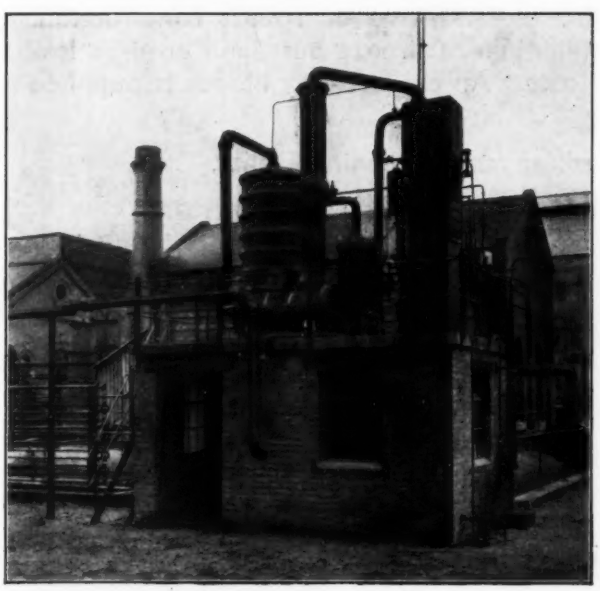

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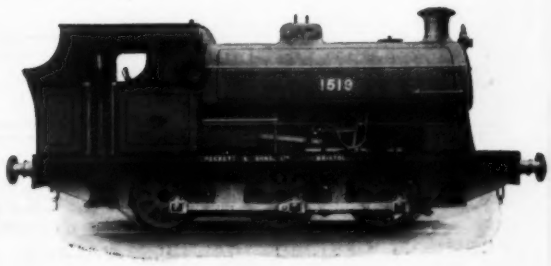

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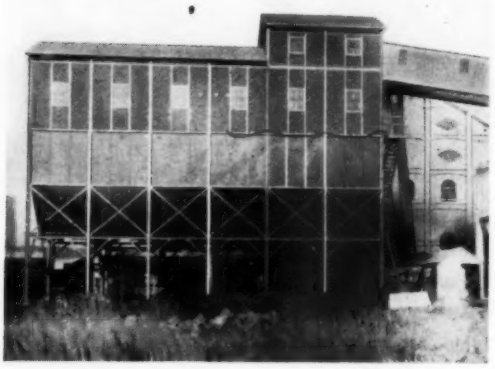

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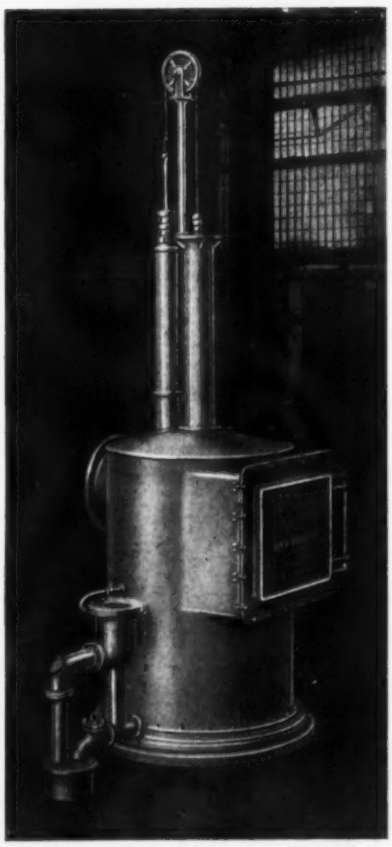

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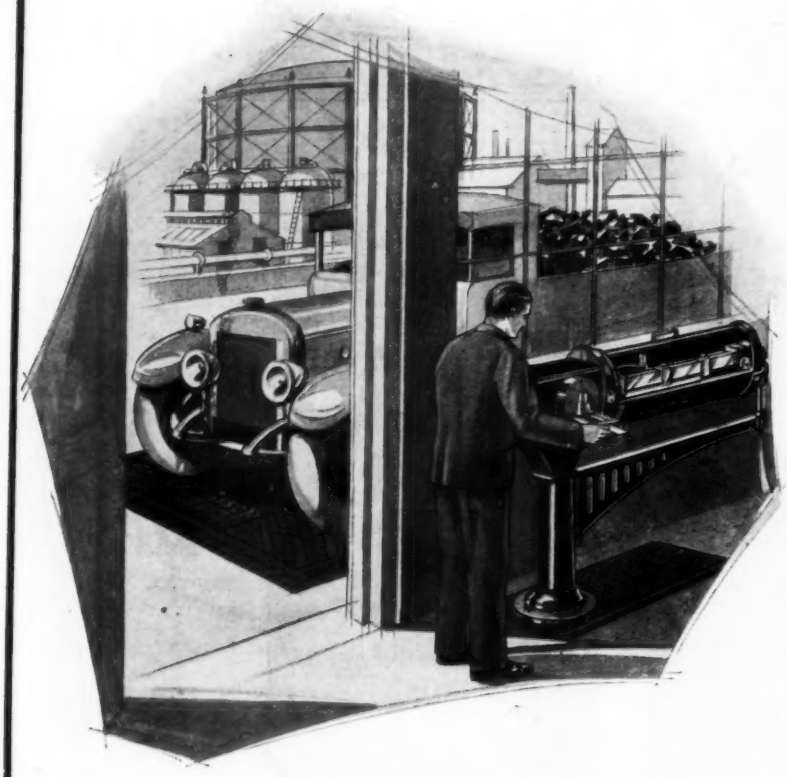

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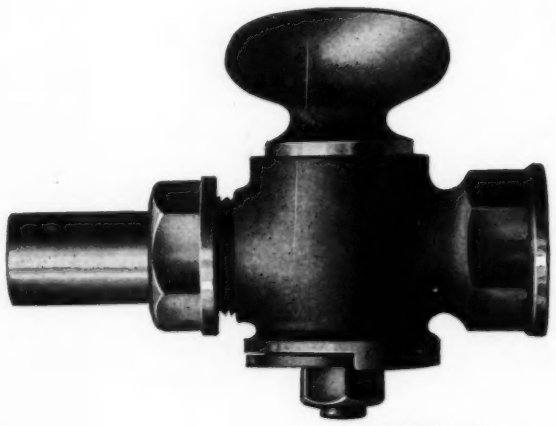

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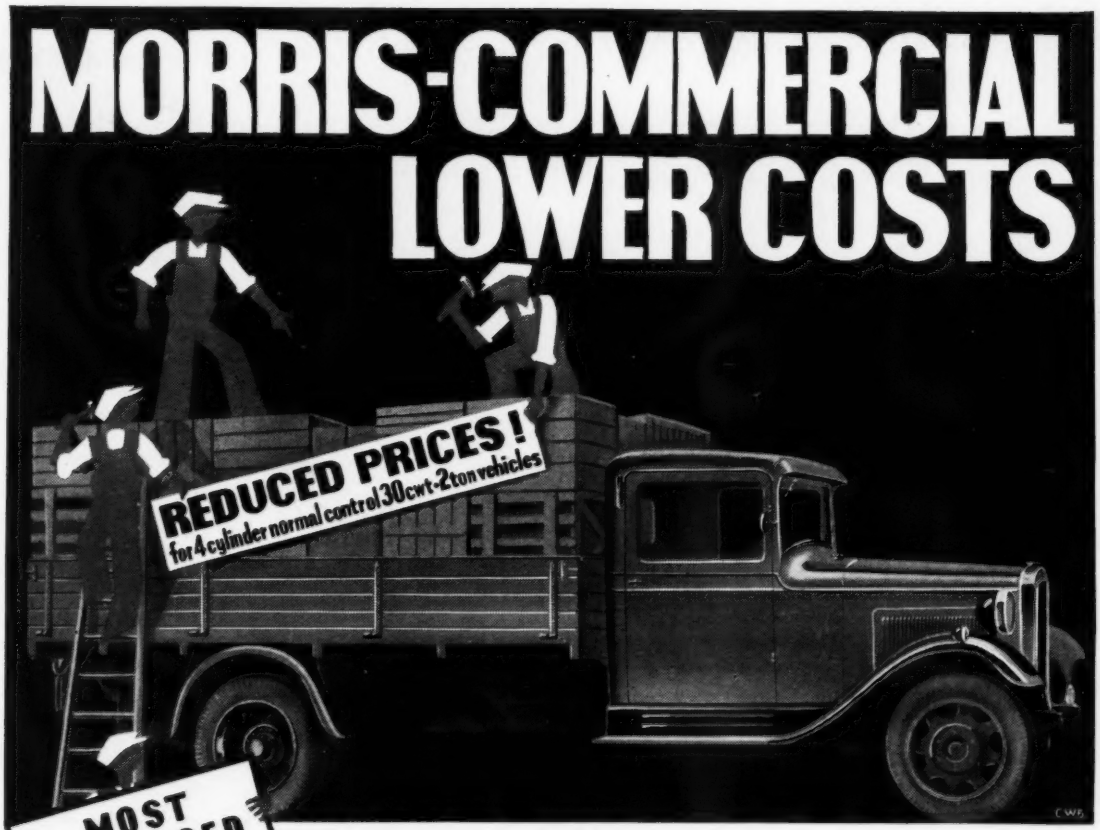

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PRODUCERS FOR GASIFYING COKE BREEZE

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PARKFIELD WORKS
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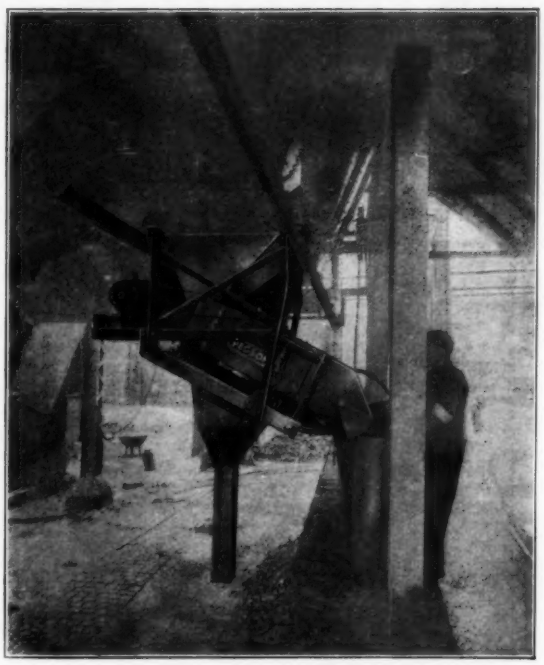

Portable unit consisting of "Live-wire" Debreezing Screen and bagging chute.

OF PROVED EFFICIENCY

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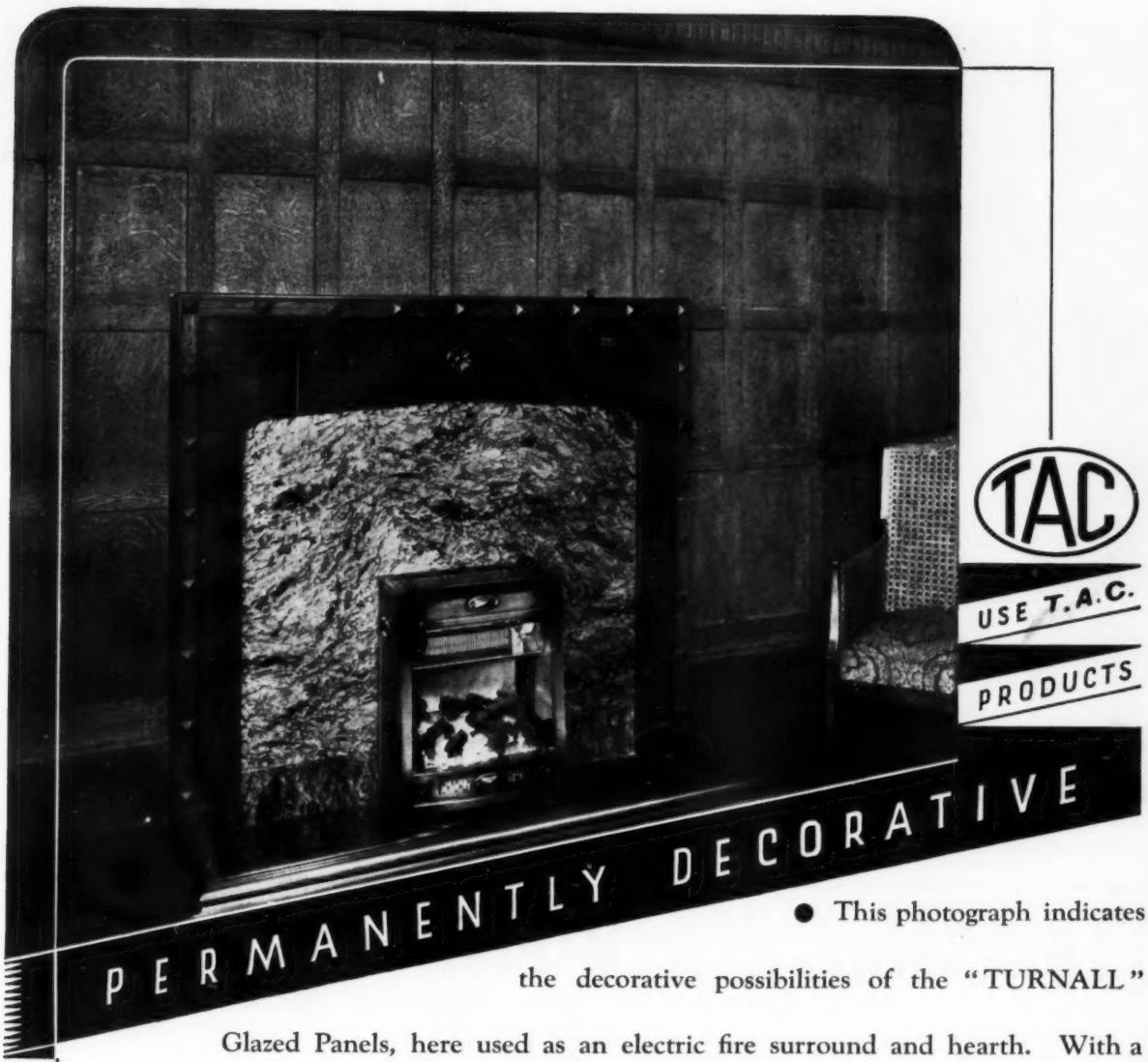

● This photograph indicates the decorative possibilities of the "TURNALL" Glazed Panels, here used as an electric fire surround and hearth. With a highly glazed finish which is exceptionally hard and non-brittle, "TURNALL" Glazed Panels have extraordinary resistance to heat and moisture. For these reasons, as well as for their attractive colours and designs, they are admirable for the panelling of walls for splash backs, bath panels, table tops, gas and electric fire surrounds, etc.

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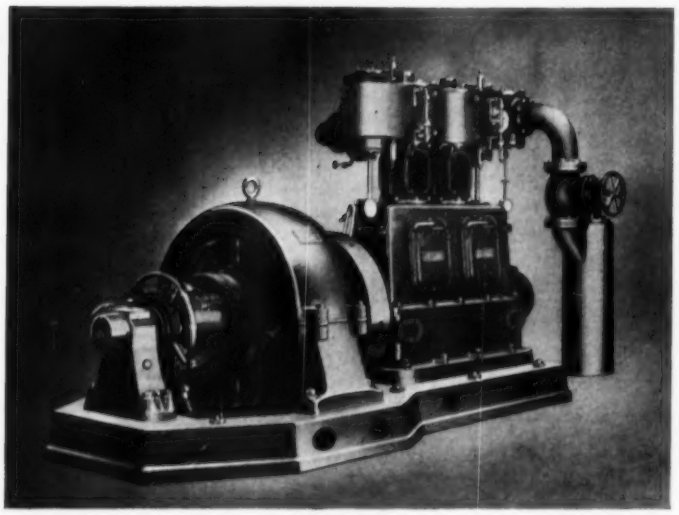

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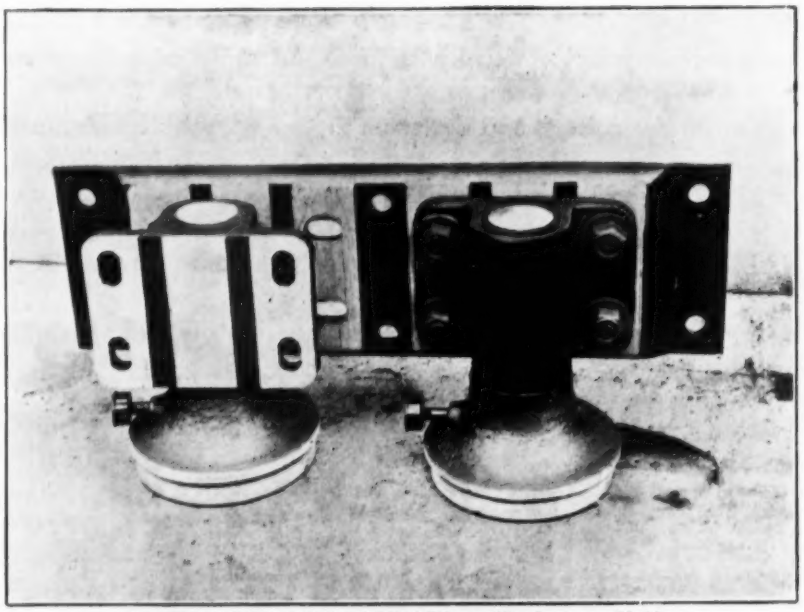

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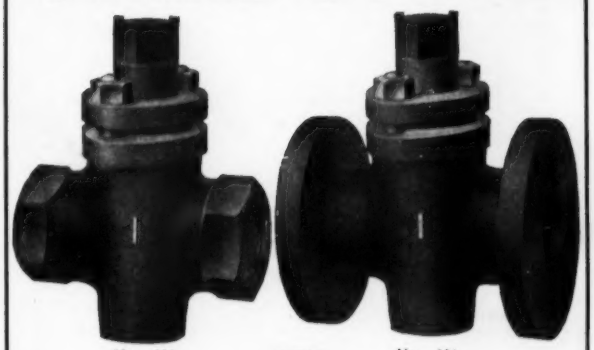

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ALL SIZES IN STOCK

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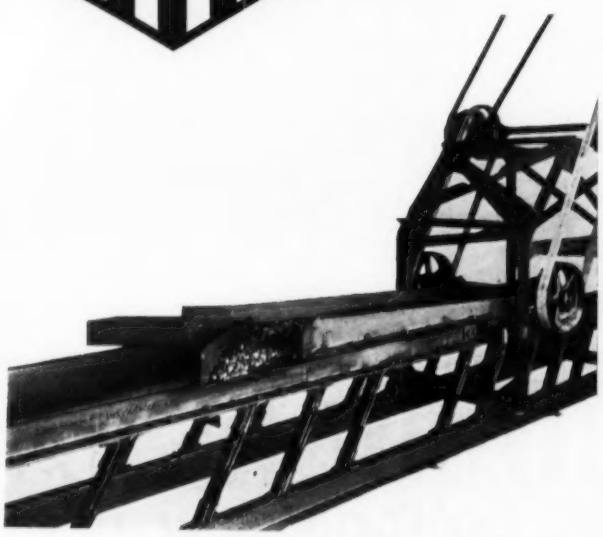

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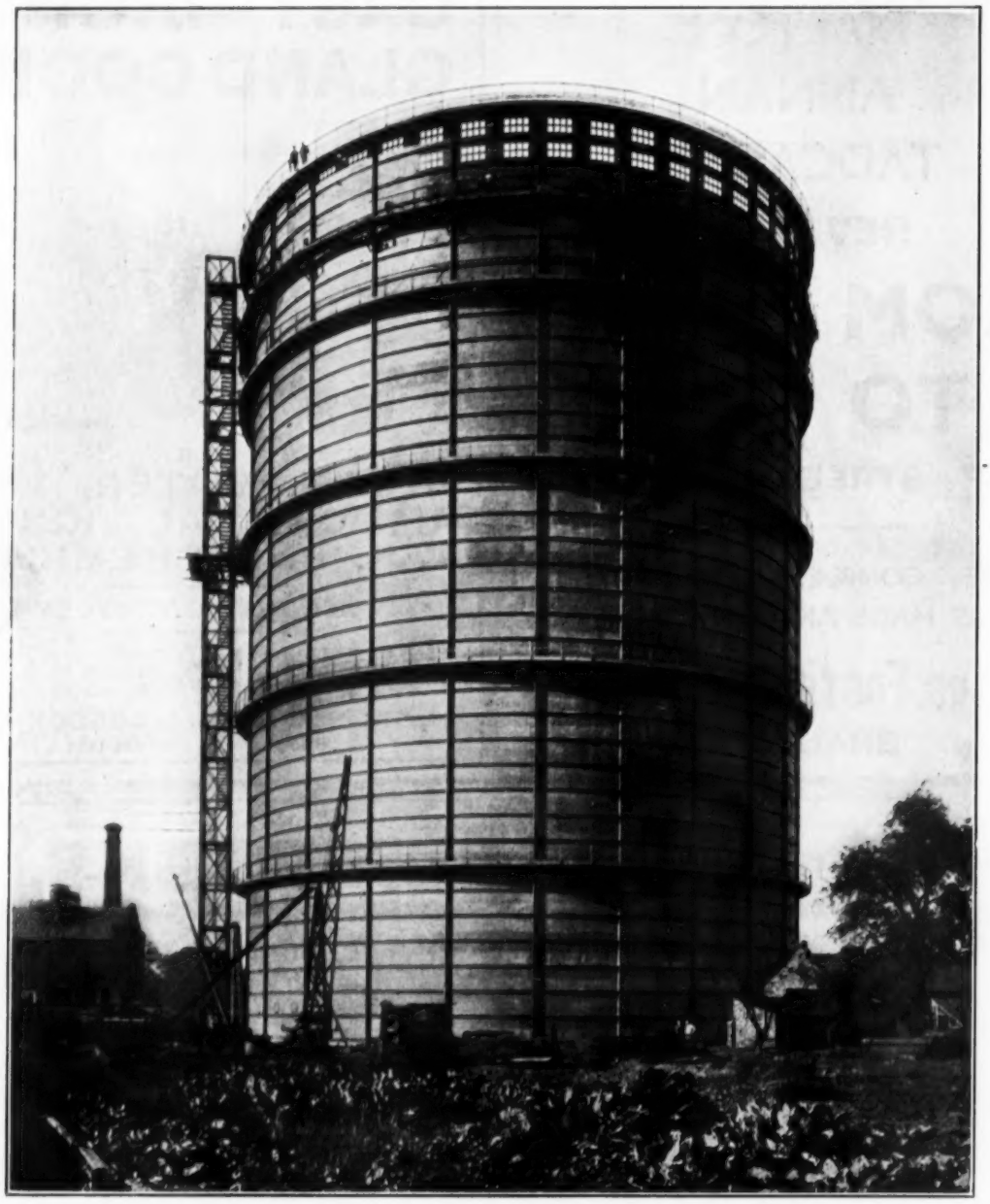

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Station Works, DENTON, LANCS.

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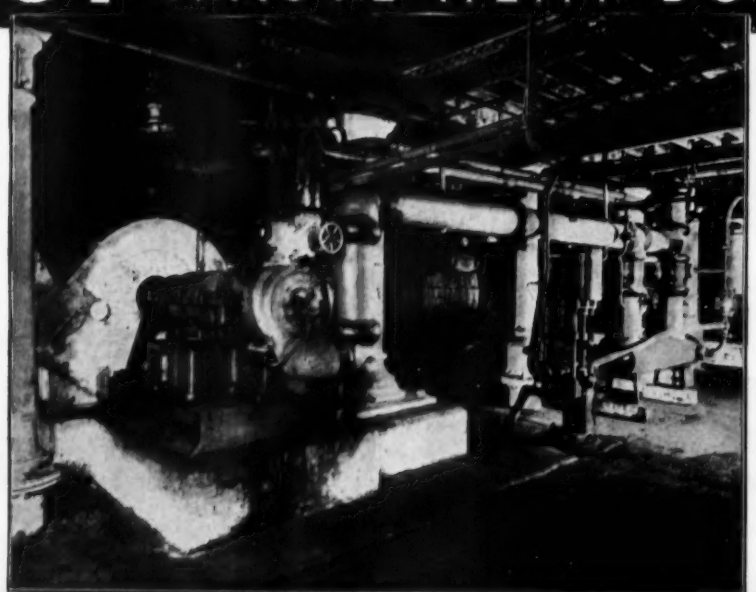
Potential buyers in the Gas Industry can be reached more surely and economically through the "GAS JOURNAL" than by any other means.

51 SPENCER-BONECOURT PATENT WASTE HEAT BOILERS...



have been supplied to the Gas Companies of Greater London alone.

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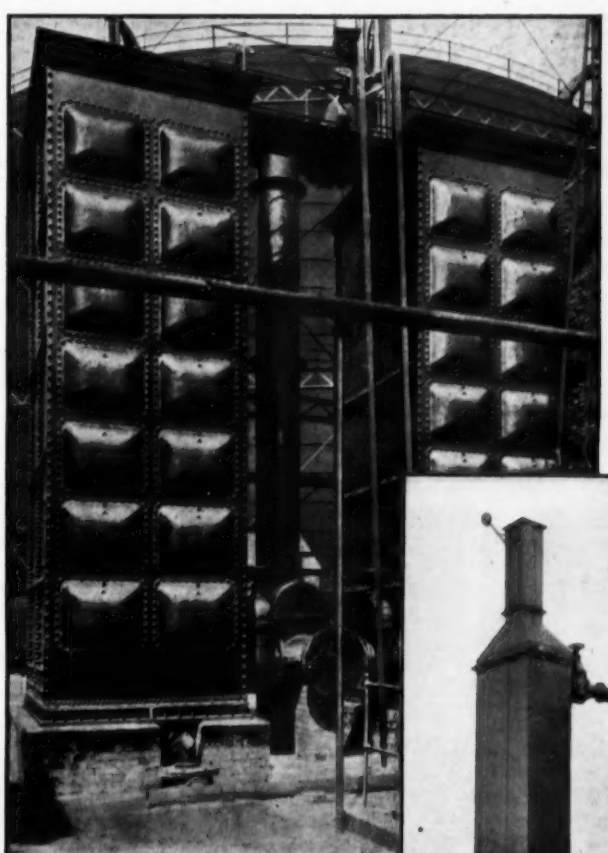

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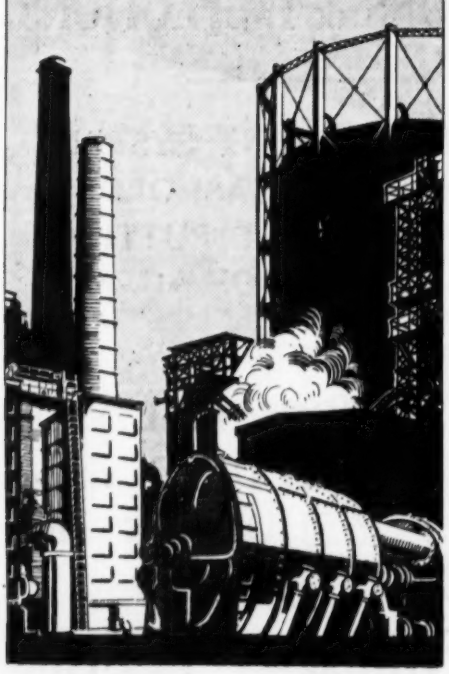

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A. Water Cooled Condenser with water cooling tower. This system operates on a closed circuit with a negligible water make-up.

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C. Atmospheric Forced Draught Condenser — a small compact type.

The above three systems are examples of the scientific designing Whessoe devote to all condenser work. We deal with every aspect of gas condensing and give guaranteed results.

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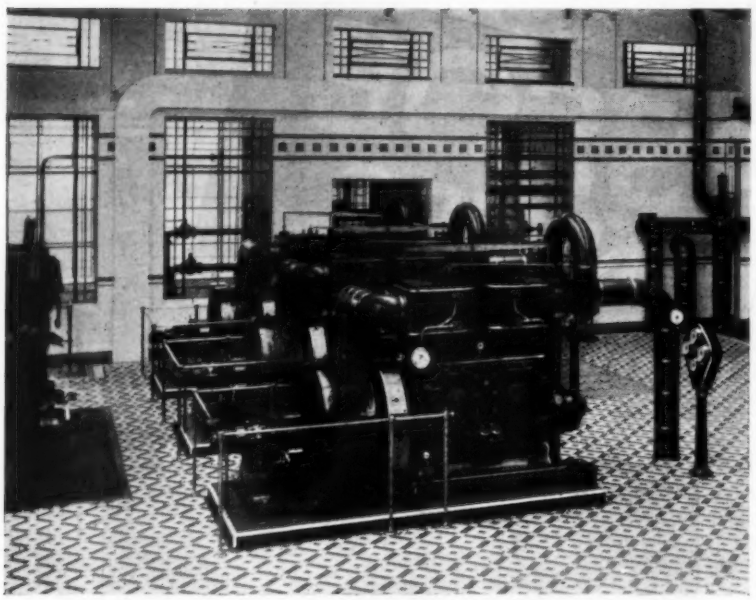

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Direct Control for Small Hotels.
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1 Maximum gas flow per unit pressure

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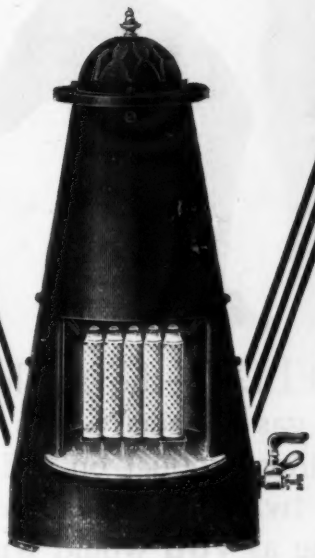

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NOW OBTAINABLE IN A VARIETY OF NEW PASTELLIC COLOURS

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DUBLIN NEWCASTLE CARDIFF LEEDS
LIVERPOOL SWANSEA
WORKS:
LONDON, S.W. BIRMINGHAM RAINHILL

The . . . .

Efficiency of a Gas Works depends upon the Retort Houses

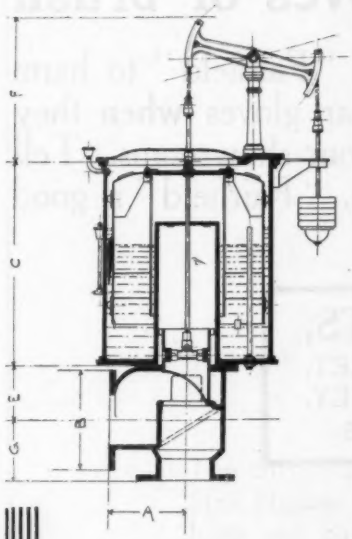
The efficiency of the Retort House—the Gas yield per ton of coal—is dependent upon Retort House Equipment.

If you are not entirely satisfied with the results at your plant we shall be glad to hear from you.

Perhaps what is wanted to bring the plant right up-to-date are Peebles' Retort Governors.

At various Gas Works the installations of these famous governors has resulted in improved efficiency.

This is a matter we shall be glad to discuss with you.



—FIG-62—

Top: Peebles' Enclosed Pattern Retort Governor.

Fig. 81a. Peebles' B.V.R. Governor. This can be used to control any conditions of pressure or vacuum.

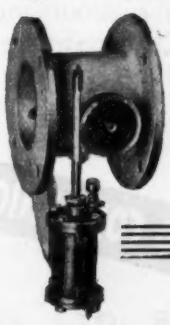


Fig. No. 81A

PEEBLES & CO. LTD.
Jay Works
Bonnington,
EDINBURGH

E.I.H.

"FAIRFIELD" KLEENER

STILL RUNNING STRONG—

It is a FACT that "FAIRFIELD"—the absolutely NON-SCRATCH wonder cleaner for gas cookers—does its job more quickly and effectively than any other product on the market. It cleans vitreous enamel or iron in a twinkling. Removes grease like magic. Leaves a gas-cooker looking as **you** would wish it to look.

"FAIRFIELD" CONTAINS NO CAUSTIC

It can be used without gloves or brush

That's another big advantage. Nothing in "Fairfield" to harm the hands. No need for housewives to wear gloves when they use it. Let housewives see "Fairfield" in your showrooms. Tell them what it does. **Show** them what it does. "Fairfield" is good propaganda for gas cookers.

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Works: ST. HELENS, LANCS.

In tins for household use at 6d. In 7lb. drums for use in large kitchens, stove repair depts., etc.

'FAIRFIELD'-THE GOOD COMPANION OF THE GAS COOKER

Astrah De-greasing Compound, non-inflammable, non-caustic for Stove Shop use: write for particulars and sample.

The chromium-plated "K.C.U." is the best and most efficient Sink Heater we have ever offered. It has been designed for long and continuous service, and the chromium-plated finish minimises maintenance costs. The 10 c.f. "K.C.U." can deliver 4½ gallons of water per hour at a temperature of 140° F., so the "K.C.U." is equal to heaters of greater capacity.

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Recent
"Labourless" Carburetted-Water-Gas Plant

EDINBURGH

May, 1933

Guaranteed capacity, with hitherto difficult Scotch Coke, 2,300,000 cu.ft. gas daily.

The Official Test of this Installation showed the following *Actual Results* without any allowance for the adverse effect of excess impurities in the generator fuel:

Total gas made during test	17,732,000	cu.ft.
Gas production per 24 hours	2,535,000	cu.ft.
Calorific value of gas	503·5	B.Th.U.
Oil used per 1,000 cu.ft.	1·996	galls.
Dry Scotch coke used per 1,000 cu.ft.	27·1	lbs.
Fixed carbon actually consumed in generator per 1,000 cu.ft.	22·86	lbs.

This 22·86 lbs. of carbon per 1,000 cu.ft. also produced automatically 57·1 lbs. of steam (from and at 212°F.) for use in the plant, and gasified 1·996 gallons oil.

The above Results, obtained when gasifying coke containing 74% fixed carbon and using just under two gallons of oil per 1,000 cu.ft., correspond to the following thermal yields from the raw materials:*

1·28 therms as oil gas from each gallon oil gasified, in addition to residual oil-tar—about 15% of the oil used.

92·1 therms as blue-gas from each 1,000 lbs. dry coke, in addition to production of the above waste-heat steam and the gasification of the oil.

**Computed by the method described in the Proceedings of The Institution of Gas Engineers, 1927-8, p. 526.*

Extract from THE SCOTSMAN of July 22nd, 1933, describing Inspection of the New Carburetted-Water-Gas Plant by the Town Councillors.

"The new Carburetted Water Gas Plant ..... is chiefly impressive on account of its automatism. There is a control table with an intricate arrangement of levers and valve apparatus, which differs from most controls in requiring no controllers. The levers go back and forward, turn sections of the machinery on and off, and generally function as if there were present Mr. H. G. Wells' 'Invisible Man' who, unseen, was operating the various lever handles.

..... A chance comer happening on the elaborate plant in its special building might have the impression that it was out of action. The functioning is practically silent. There is only the faint click of the control levers and there is no other sign of movement. During the visit one of the staff, by intentionally interfering with the automatic control made a 'fault' in the processes that were going on. ..... Then the whole system came to a standstill and the blare of a horn automatically drew attention to the fact that something was wrong. This was not all. A telltale lever indicated exactly which part of the apparatus was at fault, and as soon as this was rectified, the Robot-driven machinery proceeded once more to function."

Humglas House, Carlisle Place, London, S.W. 1.

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A UNIQUE & AMAZING METHOD OF OVEN CONSTRUCTION WHICH NO OTHER COOKER POSSESSES !

THE GOVERNOR-GENERAL GAS COOKER is the most striking advance in the development of the SINGLE BURNER OVEN.

THE PATENT BOTTOM FLUE by its ingenious method of construction compels the heat to circulate throughout the entire oven, giving a BETTER Heat Distribution before it leaves at the Bottom by means of the PATENTED DOOR FLUE. The Heat then takes its natural course up the flue in the door, along the passage over the dome of the cooker, and finally passing out of the flue outlet in the CORRECT POSITION at the top of the oven.

THE AUTOMATIC OVEN CONTROL ASSURES ECONOMICAL AND EFFICIENT COOKING SERVICE

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General Gas Appliances Ltd.
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COMBINE TO MAINTAIN THE HIGH STANDARD OF

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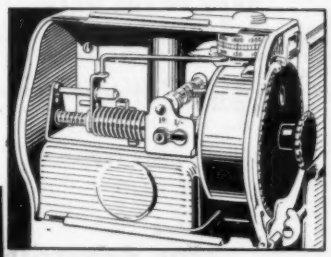

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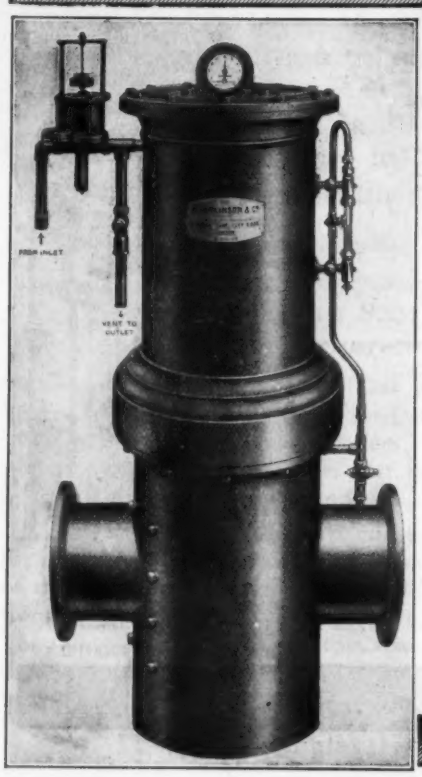

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NO HEAVY WEIGHTS TO LIFT
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INCORPORATED IN PARKINSON & COWAN (GAS METERS) LTD.
TERMINAL HOUSE, LONDON, S.W. 1.

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Iron Lane, Stechford, BIRMINGHAM.
Raphael St., Cromac St., BELFAST.

THE GAS JOURNAL

NOVEMBER 22, 1933

Vol. 204. 85th Year No. 3679

A Glance at the Contents—

Domestic Use of Bottled Gas in Denmark.

An account is given by M. Smidth, an engineer of the Nykoebing Gas-Works, of the development of the use of bottled gas for domestic purposes in two Danish Islands. [p. 583.]

Locomotive Coaling Plant.

A description is given of an interesting locomotive coaling plant, designed by Messrs. Robert Dempster & Sons, Ltd., of Elland, at Shoeburyness on the L.M. & S. Railway. [p. 584.]

Moore Gas Plant.

In a paper before the Southern Association of Gas Engineers and Managers, Mr. S. Moore gave an account of the working of the Moore gas plant at the Burnham-on-Sea Gas-Works. [p. 594.]

Yorkshire Junior Gas Association.

The 31st Annual Meeting of the Yorkshire Junior Gas Association took place on Oct. 28, at the Fuel Industries Department of Leeds University, when the new President, Mr. B. Thorp, of Huddersfield, was inducted. [p. 601.]

Automatic C.W.G. Plant at Edinburgh.

The C.W.G. plant put into operation at Granton Works, Edinburgh, last May is of interest in that, besides being the first of its type erected in Scotland, it represents the latest development of the Humphreys-Glasgow completely automatic plant. [p. 582.]

The Institution Tour.

The Editor concludes his story of the tour of the Institution of Gas Engineers to Canada and the United States of America. [p. 577.]

Lighting of Arterial Roads by Gas.

This was the subject of a paper read before the Public Works, Roads, and Transport Congress by Mr. A. M. Bell, Public Lighting Superintendent to the Tottenham and District Gas Company. [p. 598.]

Compressed Gas Filling Station Opened.

The Secretary for Mines, Mr. Ernest Brown, M.C., on Wednesday last inaugurated a compressed gas filling station for the use of motor vehicles, at the works of the Chesterfield Tube Company. [p. 585.]

Preparation of Coke for the Market.

Mr. H. Singleton, Engineer and General Manager of the Huddersfield Corporation Gas Department, dealt with this subject in a paper which he read before the Yorkshire Junior Gas Association on Oct. 28. [p. 601.]

A Coal Handling Problem.

A paper of value to mechanical engineers was submitted for discussion at last week's meeting of the Southern Association. This contribution, by Mr. R. J. H. Clark, Engineer to the Plymouth and Stonehouse Gas Light and Coke Company, is a straightforward account of how the author, faced with a difficult and uncommon coal handling problem, succeeded in effecting economies. [p. 590.]

Forthcoming Engagements

Nov. 25.—NORTH OF ENGLAND AUXILIARY ASSOCIATION.—Half-yearly Meeting at Newcastle. Paper by Dr. G. P. Lishman, F.I.C.

Nov. 25.—WESTERN JUNIOR ASSOCIATION.—Meeting at Bath. Inspection of Messrs. Stothert & Pitt's Pump Department. Paper by Mr. G. K. Rose.

Nov. 29.—MANCHESTER DISTRICT ASSOCIATION.—Meeting with N.W. Section, Institute of Fuel, Manchester.

Nov. 29.—I.G.E.—Meeting of Meters Committee, 2.30 p.m., 28, Grosvenor Gardens, S.W. 1.

Dec. 1.—WESTERN JUNIOR ASSOCIATION.—Meeting at Bath. Address by Mr. F. P. Tarratt.

Dec. 2.—SCOTTISH EASTERN JUNIOR ASSOCIATION.—Visit to R. & A. Main, Ltd., Falkirk. Paper or Cinema Display.

Dec. 6.—MANCHESTER AND DISTRICT JUNIOR ASSOCIATION.—Visit to Thomas Glover & Co., Ltd., Manchester. Lecture on the "Manufacture of Meters."

Dec. 7.—MIDLAND JUNIOR ASSOCIATION.—Meeting. Paper by Mr. G. H. Davies.

Dec. 8.—LONDON AND SOUTHERN JUNIOR ASSOCIATION.—Meeting. Paper by Mr. H. J. Risby.

Dec. 9.—SCOTTISH WESTERN JUNIOR ASSOCIATION.—Meeting. Paper by Mr. A. Bujnowski.

Dec. 11.—I.G.E.—Meetings of Finance Sub-Committee, 2 p.m.; Membership Sub-Committee, 2 p.m.; General Purposes Committee, 3 p.m.; Benevolent Fund Committee of Management, 4.30 p.m., 28, Grosvenor Gardens, S.W. 1.

Dec. 12.—I.G.E.—Meetings of Council, 10 a.m.; Gas Education Executive Committee, 4 p.m., 28, Grosvenor Gardens, S.W. 1.

Dec. 14.—S.B.G.I.—Meeting of Council, 56, Victoria Street, S.W. 1, 2.30 p.m.

Dec. 16.—YORKSHIRE JUNIOR ASSOCIATION.—Meeting at Huddersfield. Presidential Address.

Dec. 16.—WALES AND MONMOUTHSHIRE JUNIOR ASSOCIATION.—Meeting at Cardiff. Paper on "Modern Methods of Manufacturing Malleable Iron Pipe Fittings," by Mr. C. E. Green.

Dec. 21.—I.G.E.—Meeting of Refractory Materials Joint Sub-Committee, 2.30 p.m., 28, Grosvenor Gardens, S.W. 1.

EDITORIAL NOTES

"Seeing is Believing"

IN spite of the classic declaration of the Old Lady who, on first seeing a Giraffe, exclaimed: "I don't believe it!" one may accept as a general truth that "seeing is believing." This, at any rate, is the frame of mind in which we approach the published advertisement of two Electricity Supply Companies to the effect that decisions to light certain thoroughfares by electricity "*were arrived at on the grounds of the pre-eminence of electric street lighting for road safety for drivers and pedestrians*," &c. Since the appearance of this announcement, in "pre-eminent" black type over double-column measure, there has been quite a spate of reports of places being "in the dark," and this fact induces dubiety as to the soundness of these "grounds of pre-eminence" for "road safety"—though we would certainly not go so far as did the Old Lady on first meeting the Giraffe.

On the day following the appearance of the aforesaid advertisement, the very paper in which it "saw the light" (the *Daily Express*, Nov. 14) stated in its news columns that:

> "Many shops in the Hackney district of London sold out their stocks of candles last night when an electricity failure caused a 'black-out' that was only partially remedied after five hours. Cinema shows were stopped. In one picture house members of the audience played the piano or led the remainder in community singing. Patients in a local hospital were tended by candle-light."

In the *Cambridge Independent Press* (Nov. 17) we are informed that:

> "Cambridge was thrown into a state of chaos on Wednesday afternoon by the failure of the electric light system over a very wide area. The breakdown started when lights grew dimmer and dimmer and finally went out altogether. Shops, offices, and private houses all over the town were affected, and candles brought into use. At the time of the failure the Mayor and Mayoress were holding an 'At Home' at the Guildhall. They also were plunged into a state of darkness, and had to carry on by the light of candles fetched by guests. Shops in the centre of the town, all along St. Andrew's Street and Regent Street were blacked out, and the only lights to be seen were those of the street lamps and passing cars. One ingenious garage proprietor switched on the headlamps of cars in the shop window showrooms. A reporter was informed that at Addenbrooke's Hospital, fortunately, no operations were in progress. At the Rendezvous and Tivoli Cinemas the light went off for about 25 minutes, but came on then. The Kinema and Playhouse were still affected at 5 o'clock; but the Central and Victoria, having their own stand-by system, managed to carry on. At the *Cambridge Daily News* offices all the composing machines stopped for lack of motive power, and for the same reason the new rotary press was unable to start until the supply of current was resumed. Headlines could, however, be set by hand with the aid of a supply of wax tapers. The later copies of the one edition published, gave an account of the failure, written by the light of a bicycle lamp. In the centre of the town light came on at about 5.25 p.m."

Several factors are said to have been responsible for this "extensive failure." Though the primary cause was the "failure of the grid supply," wind and dead leaves also receive a share of the blame. But Cambridge was not the only town to suffer from the failure of the grid supply, as will be seen from the following account culled from the *Bedford Times* of the same date (Nov. 17):

> "For fifty minutes early on Wednesday evening the town of Bedford and the whole area supplied by the Borough Electricity Undertaking (extending into Cambridgeshire and Huntingdonshire) were without current. Shortly before 4.30 all electric lights went dim, and then, after a momentary brightening, failed altogether. Machinery came to a standstill, heating apparatus ceased to function, and all-mains radio sets were dumb. Time itself—at any rate, as registered by electric clocks—stood still. In the streets the gloom of the November twilight was relieved only by the occasional brilliance of shops illuminated by gas. There was a sudden demand for candles, and large quantities were sold during the first few minutes of the breakdown. At the General Post Office and in many shops and business houses work was continued by means of this primitive light. At certain of the large stores there was some confusion when the darkness descended; but the stand-by gas-lighting system was brought into use without much delay. In High Street, Bedford, the traffic was controlled by policemen, the automatic signals having stopped working. Ardor House (the Gas Company's offices and showrooms) was naturally a blaze of light, but at Electricity House people were paying their bills by candlelight."

Lest we should be accused of unfairness, it may be added that the same issue of the Bedford paper says:

> "At Sandy there had been a four-hour failure of the gas supply earlier in the day."

But for the moment it is with the favouring of electricity on the ground of "pre-eminence" in the matter of "road safety" that we are dealing; and other quotations bearing upon this point may be made. The *Evening News* (Nov. 18) reports:

> "Canterbury was without electricity for more than an hour this afternoon, because of trouble at the city's electricity works. Herne Bay was also affected."

And, again, from the *Sunday Dispatch* (Nov. 19) we learn that:

> "Business was conducted by candlelight in the Wandsworth Bridge Road district of Fulham last night, when the electricity supply temporarily failed."

Bottled Gas

ON later pages an account is given of the development of the use of bottled gas in two Danish Islands, where, at the present time a thousand consumers are enjoying, at low cost, all the advantages of a town gas supply. The idea of bottling town gas is not, of course, by any means new, but the translation of this idea into practice has only been possible by the manufacture of high-tensile steel containers to withstand very high pressures. Another factor which has had a major bearing on the success of the scheme is the development of motor-lorry transport.

The article to which we refer is doubly interesting because, apart from describing the general scheme, it sets out all the costs of distributing bottled gas. The two islands supplied are Lolland and Falster, and the most distant consumer is situated 44 miles from the gas-works. The prices for domestic installations are, according to type, £13, £15, and £20; and the consumer can, if he

chooses, adopt the instalment plan of purchase, the limiting period being ten years. Then the bottled gas, which has a calorific value of 500 B.Th.U. per c.ft., is supplied at the comparatively low rate of 6s. 4d. per 1000 c.ft.

Two types of cylinder are in use. One has a capacity of 1·4 c.ft. of water, and, when charged to a pressure of 150 atmospheres, contains 210 c.ft. of gas. The weight, including valves, is 160 lbs. The other type, of alloy steel, has a water capacity of 1·75 c.ft., and, at 200 atmospheres pressure, has a gas capacity of 350 c.ft. The weight is 130 lbs. The latter type of cylinder is used for the more distant consumers, since the saving in transport consequent on the difference in weight (0·37 lb. per c.ft. of contained gas, against 0·77 lb.) more than compensates for the extra cost, which is soon paid off. In the island of Falster, distribution is effected by motor lorries owned by the gas supplier. Each lorry departs from the compressor station with thirty charged cylinders, and every consumer is visited twice a week on definite days. Consumers are provided with green flags to be fixed outside their premises when a new cylinder is required. The average consumption per consumer is 42 cylinders per annum, and each domestic installation comprises two cylinders. The arrangement of the various connections gives the consumer a simple, as well as a safe and reliable, gas supply.

In Lolland, which is larger than Falster, the cylinders are distributed in co-operation with the railway company. Cylinders are delivered from a truck to the various stations three times a week in accordance with requirements, and are distributed to the consumers by a service of lorries organized by the railway company. A fixed fee per cylinder is paid to the railway company independent of the distance. All this sounds very easy; the people in the rural areas of these two Danish islands now have at command all the amenities of a modern gas supply. Actually it is the result of much patient investigation by the Gas Industry, and it shows how the Industry interprets Gas Service.

Compressed Gas for Motor Vehicles

ANOTHER article in to-day's "JOURNAL" describes the opening, by the Secretary of Mines, of a compressed gas filling station at the works of the Chesterfield Tube Company, Ltd.—here again the result of patient investigation. The compressing station has been erected in conjunction with the Bryan Donkin Company, Ltd., who have been responsible for the compressor plant itself, while the Chesterfield Tube Company make the high-pressure cylinders by the weldless solid-drawn process. The storage cylinders are charged to a pressure of 5000 lbs. per sq. in., and the traction cylinders to 3000 lbs. "Provisional Regulations" have been issued by the Home Office in regard to the manufacture and use of these cylinders, and our account of the remarkable properties of these alloy steel cylinders indicates how very safe they are in use. The whole outfit is a triumph of engineering skill, and not the least important item is the two-stage governing of the pressure of the gas from the cylinder to the carburettor, the special governor being made by the Bryan-Donkin Company.

Under the conditions at Chesterfield, with gas of a calorific value of 480 B.Th.U., 250 c.ft. is equivalent to one gallon of petrol; and figures are given of the cost of compression, including maintenance, labour, and interest and depreciation charges. The total is 1s. 1½d. per 1000 c.ft. Thus, with gas costing 2s. per 1000 c.ft. at the inlet to the compressor, its equivalent in petrol cost is 9⅜d. per gallon. Nor is first cost the only advantage possessed by gas as a fuel for heavy motor transport. Trials have brought to light several important facts, among them being that, with gas, the need for decarbonization of the engine is less frequent; the engine starts up more easily on gas than on petrol; with gas the engine can take full throttle almost instantly from cold; increased acceleration can be obtained; the engine fires more evenly at slow speeds, whether idling or under load; and obnoxious exhaust gases are reduced to a minimum. As for re-fuelling a gas-driven vehicle, this is accomplished simply and speedily, the operation taking less than a minute—a matter which evoked favourable comment at the inauguration ceremony.

Suitable compressors capable of raising from 600 to 6000 c.ft. of free gas per hour to a pressure of 5000 lbs. per sq. in. are already in service in different parts of the country, and the installation of many new stations is receiving the serious consideration of the authorities concerned. In this connection it is understood that the Lincoln Corporation intend shortly to open a gas filling station and to convert their motor 'buses to run on gas. When the facilities become available every gas undertaking should assist in a very good cause by converting their own heavy motor vehicles to gas propulsion.

Flexible Carbonization

IN his paper on coal carbonization by internal heat which he read at the meeting of the Southern Association of Gas Engineers and Managers last week, Mr. Samuel Moore, of Burnham-on-Sea, made it clear that, in pointing to the remarkable flexibility of the Moore plant—developed by himself and his sons—he in no way disregards the merits of the continuous vertical retort for the small works. He claims for the Moore plant, however, that, for a small works, it combines flexibility with very low first cost. And if he had a large works he would have the necessary number of "robot" gas-making machines on the internal heating principle so worked as to satisfy the demands for several types of coke as well as meeting the requirements for town gas. Certainly the latest Moore plant at Burnham-on-Sea, erected by Messrs. Andrew Barclay, Sons, & Co., Ltd., is a good piece of engineering work and well merits the attention paid to it by the Southern Association.

In the Moore plant the coal is carbonized by the hot water gas during the "run," by the radiant heat from the incandescent coke in the water gas zone, and by heat conducted through the regenerative chequer-brick chambers surrounding the retort. The arrangements made to admit both secondary and tertiary air for combustion of the "blow" gases are a noteworthy feature of the plant and ensure high thermal efficiency in working—an efficiency which is further raised by passing the waste gases through a boiler. All controls for operating the desired cycle of blow and run are mechanically worked, and the entire process of gas-making can go forward for hours without needing any manual attention. At the Burnham-on-Sea Works there are two Moore plants—the one mentioned, which was installed last year, and a manually-operated unit erected some time ago and now used as a stand-by. Some of the works mains are not adequate to deal with the simultaneous output of both plants, and neither can satisfy the total demand for gas. Hence two old beds of horizontals are used to supplement the make. These beds are kept in continuous operation, and the Moore plant provides the additional gas required—varying from 25% to 75% of the total daily make, according to seasonal requirements. This method of working is, of course, open to criticism in that the composition of the gas supplied throughout the year must vary—which is not good practice. But Mr. Moore states that no consumers have made any complaints on this score, and that general satisfaction prevails as to the gas supply.

There were difficulties at Burnham-on-Sea in arriving at accurate figures in regard to the working results of the Moore plant, for there is no meter to measure the gas from the plant separately, but allowing for any slight discrepancies due to this, the figures set out in the paper indicate extraordinarily good working. And as for general considerations of labour, maintenance, trouble-free operation, and saving in ground space—these have afforded the liveliest satisfaction. Moreover, the plant implies complete control of the coke market. The first Moore plant at Burnham was erected in 1928 by the Gas Company's workmen. After 4½ years' use it was shut

down for examination and repairs. The total cost of the repairs was under £25. At maximum output the two generators are capable of producing 500,000 c.ft. of lightly carburetted mixed gas per 24 hours, and the cost of the whole combined installation was under £6000. Since 1928 Mr. Moore has saved £1900 every year on his gas production costs, and this has enabled the Company to maintain satisfactory dividends, open a well-stocked modern gas showroom, generally improve the works and property, double the capacity of the works, reduce gas prices by 1d. per therm, introduce a scheme of "free" maintenance, and modernize Company-owned cookers and fittings. Mr. Moore concludes his paper thus: "Despite strenuous competition from 'penny-per-unit' electricity, acute local effects of economic depression, no street lighting by gas, and no industrial consumers, the Burnham Gas Company distributes over 50 million c.ft. of gas per annum in a town of less than 6000 inhabitants, and sells 30,000 c.ft. of gas per domestic consumer per annum. The Burnham Gas Company is now in a stronger position financially and otherwise than ever before."

A Coal Handling Problem

A PAPER of value to mechanical engineers was submitted for discussion at the same meeting of the Southern Association. This contribution, by Mr. R. J. H. Clark, Engineer to the Plymouth and Stonehouse Gas Light and Coke Company, is a straightforward account of how the author, faced with a difficult and uncommon coal handling problem, succeeded in effecting economies, and it is particularly interesting in that it explains in some detail why certain schemes considered were not adopted. The Plymouth Company carbonizes about 80,000 tons of coal a year, all of which is water borne. Part of this coal has to be discharged at a quay owned by a local Harbour Company, transported to a stocking ground adjacent, and reclaimed for use at the works some distance away. The remainder is transported direct to the works. Steam wagons are used for carrying the coal to the storage ground, and in 1926 a hired crane with a handling capacity of 20,000 tons a year was used for stacking and reclaiming. On the basis of this capacity, the cost of stacking and reclaiming was about 9½d. a ton.

It was necessary to bear in mind that at some future date the site might be used as a main storage rather than as a reserve source of supply. Accordingly three major schemes, on the basis of a 50,000 tons per annum handling capacity, were considered—telpher, drag line, and tripper conveyor. The costs per ton of coal handled are given as 8·02d., 7·21d., and 6·26d., respectively, these figures representing the cost of handling coal from the point of discharge at the quayside hoppers, stacking into the store, and ultimately reclaiming into wagons for transit to the works. None of these schemes was adopted, but Mr. Clark makes it clear that, had the quantity of coal to be handled been greater, the employment of one of them might have proved amply justified. It was ultimately decided to install a purely portable type of plant for stacking wagon-delivered coal, and reclaiming it into wagons, leaving the site itself free for the erection of a handling installation should the development of the undertaking suggest the economy of a further alteration.

A caterpillar crane and wheeled hopper were installed, and the author explains why he was led to this choice. The crane is a Ruston Bucyrus—actually a standard excavator fitted with an ordinary jib. With one man it is easily capable of handling 60 tons per hour, but the employment of another man would permit of its being worked at double the rate. In the author's words, it has "an exceptional turn of speed when rapid working is rendered necessary." On a basis of 20,000 tons per annum, the cost per ton of coal handled would be 6d., compared with the previous figure of 9½d. with the hired crane. On a basis of 50,000 tons a year, the handling cost would be 3·3d. a ton with the Ruston crane. To bring this figure into line with the major schemes considered, it is necessary to add 2·05d. per ton, representing the cost of transporting the coal from the quayside hoppers to store. Even so, the total, 5·35d., shows a saving over the lowest cost of the schemes—6·26d. for the tripper conveyor and petrol crane.

The paper was aptly described by Mr. G. M. Gill as providing a model of the way in which preliminary work should be carried out before new plant was installed; and Mr. D. C. Cross said it afforded a good example of how not to rush into the scrapping of old plant, and how not to take it for granted that it was absolutely necessary to install a new plant in order to reduce costs.

Lighting and Accidents

AMONG municipalities throughout the country which own neither gas nor electricity works, 81% of the street lamps are gas; where municipalities own both services, 78% of the lamps are gas. Only where municipalities own electricity but not gas-works is the percentage of gas lamps smaller—a matter of 42. These figures from the Municipal Year Book, quoted by Mr. Robert Watson, of Doncaster, at the autumn research meeting of the Institution of Gas Engineers this month should provide encouragement to further effort to improve public gas lighting service. So also should figures mentioned by Mr. A. M. Bell, Public Lighting Superintendent to the Tottenham and District Gas Company, at the Public Works, Roads, and Transport Congress last week. Mr. Bell, in the course of the discussion on a paper he presented on the lighting of arterial roads by gas, stated that over 90% of the street lighting in the area of supply of his Company is by gas.

Mr. Bell describes the gas lighting of the Great Cambridge Arterial Road, and he raises a point of great importance in connection with the lighting of arterial roads in general. Arterial roads are constructed to make short travelling distances between towns, to divert traffic from busy shopping centres, or to by-pass towns. The Great Cambridge Road passes through the areas of five different councils; it by-passes all shopping centres, and it cannot be said to bring trade to any neighbourhood; on one section only is it completely built upon. The Council with the lowest rateable value has the largest section of the road to light. The death roll on the road is heavy, and emphasizes the need for good lighting, but the burden placed upon the particular Council is disproportionately heavy. The ratepayers are expected to foot the bill for lighting a road which is of little or no interest to them. This is what Mr. Bell has to say about the matter: "I contend that good street lighting is as necessary and as important as any other public service, and is one of paramount assistance to the police in their work of maintaining law and order. The cost of installations and the annual expenditure cannot be borne to the same extent by a country town as it can by a wealthy city, neither can a comparatively few residents be expected to contribute by voluntary taxation a large sum, when they already pay for public services. I consider that all roads in the country should be graded, the necessary lighting correspondingly graded, and the expense paid out of a common fund to be contributed to by all local and county authorities, and to include a considerable contribution from the Road Fund."

This suggestion appears to us an admirable one. A correspondent to *The Times* of Monday last stated that in the first nine months of the present year the number of persons killed in road accidents in England and Wales was 4688, and the number of injured 151,396. During the whole of the Boer War our total loss "killed in action" was 5774; total wounded, 20,811. And there are still three months of 1933 to swell the number of killed and injured on the roads! In the discussion on Mr. Bell's paper, Col. Oakes gave figures from an investigation of 3029 accidents, of which 1066 occurred during hours of darkness, which indicate that the number of accidents is much less where there is good artificial lighting. "It is," he said, "reasonable to suppose that lives would have been saved if there had been better lighting at the points where the accidents occurred." The necessity for the adequate lighting of our roads is being brought home more and more; and in this lighting gas has a most important part to play.

Any consideration of adequate lighting must include

mention of maintenance. Nothing is more necessary in street lighting than a proper system of maintenance. A drop of 20% in efficiency may easily occur by a comparatively small amount of dust and dirt on glass or reflectors, while anything up to 50% reduction may be experienced if cleaning is neglected for a few weeks. In brief, good maintenance pays for itself. Commenting on maintenance in his paper, Mr. Bell refers to the point, not widely known, that a gas mantle instead of diminishing in illuminating power, often increases in efficiency with use. Of course, there is a time limit. Mr. Bell sets the limit at 1000 lighting hours, but Mr. F. C. Smith, of the Gas Light and Coke Company, thinks that 200 hours is nearer the mark. On this question as on many others in connection with lighting, the Gas Industry is busy at the present moment.

Selling Dry Coke

Gas engineers who sell water instead of coke are doing the Industry immense harm. This was the contention of Mr. Holton, of Manchester, at the autumn research meeting of the Institution of Gas Engineers this month. At Manchester the coke supplied to domestic consumers does not contain more than 1½% of water. During the same meeting Mr. Firth, of Leeds, outlined the results of experiments to determine the causes of noisy burning and "fliers." He has arrived at the conclusion that silent burning and absence of "fliers" depend, not on the moisture content of the coke, but on the procedure adopted in cooling the coke. Shock quenching by water makes a noisy coke prone to "fliers." Controlled cooling by inert gases produces a silent burning, perfectly safe smokeless fuel. In one of the experiments a sample of noisy burning coke was placed in a retort and heated to 900° C., and then withdrawn and air cooled. The result was a silent burning coke.

All this is highly interesting in view of the paper by Mr. Singleton, of Huddersfield, published in the "Journal" to-day. His contribution is entitled "Preparation of Coke for the Market," and it contains excellent advice and suggestions. His opinion is that, to stimulate a good demand for gas coke more is needed than mere screening and grading. In the first place, the Gas Industry must purchase coals not only for their gas-making properties, but more than ever before for their coke-making qualities. These coals must be low in ash and well cleaned. A well cleaned coal may still contain ash in a finely divided state throughout the coal, but a coal with, say, 5% of well distributed ash of high fusion-point is a very much better proposition than coal with the same total amount of ash in the form of bats or scales. Then, the coke should be sold dry; and it is in this respect that Mr. Singleton's paper is so fascinating. He has been carrying out an investigation into the drying of cokes after quenching. A sheet iron hopper is used, into which the coke is placed. From the base of the hopper a pipe leads to a fan connected to the main flue of the setting; and hot waste gases are forced through the hopper. The dried cokes, states Mr. Singleton, burned extremely well in an open grate. These tests are only preliminary, and further tests are being carried out. The practical application of the method to coke hoppers and storage grounds has been provisionally protected. The question of screening and de-breezing becomes a very simple operation if the coke is perfectly dry, and all will admit the advantage of being able to deliver to the consumer a dustless coke.

On Size

Those who flatter the Editor by reading his concluding article on the Institution trip across the Atlantic will notice that, in presenting, on behalf of every member of the party, a silver loving cup to Mr. F. P. Tarratt on board the "Georgic," Mr. T. F. H. Lapthorn said that they had seen many of the biggest things in the world—so many that he had lost count of them. This is unquestionably a matter in which our friends on the other side take a considerable amount of pride, and, generally speaking, this feeling of pride in bigness is perfectly understandable.

But "size" may sometimes have its drawbacks. We often complain, for example, of the size of our mails—by this, of course, meaning the number of communications contained in the post-bag—but when this question of size extends as far as the paper on which our communications are written, there is an added difficulty, inasmuch as unduly large pieces of paper are, as a correspondent points out, "very inconvenient to file in any place except the waste-paper basket."

It is the fact that files and boxes for letters, invoices, &c., are made to standard dimensions, and office organization must be facilitated by adherence to these sizes. Thus it is that our correspondent, who has observed a growing tendency to write on larger and larger sheets, suggests the desirability of remaining loyal to a standard size of paper, preferably 10 in. by 8 in., and of only moderate thickness. Is our correspondent correct in his suggestion that "there is an idea that the larger the paper the more attention it receives?" If so, his further remark is worthy of attention—"that in putting letters on one's table in the morning, the large papers are always placed at the bottom."

A Jolly Good Effort

An example of first-rate advertising is provided by the recent enterprise of the City of Leicester Gas Department; and the Engineer and Manager, Mr. James Mitchell, who has sent us along a couple of pages from one of the local newspapers, deserves the results of taking the bull by the horns, and advertising really effectively. We have often called attention to the need for supplementing national propaganda by local effort, and we are not surprised that, by adopting this plan, Mr. Mitchell is doing so well with his sales. Mr. Mitchell arranged a "gas fire week" at the beginning of the month, and advertised the fact in the local Press, to link up with the special showroom display of gas fires in colour. Four-colour printing was used, and evoked keen interest in what the Department had to offer. An all-in price, including free fixing up to 20 ft. of piping, was quoted during the week; and the business in coloured gas fires *increased tenfold*. The fires are coloured by the Department's own spraying plant.

PERSONAL

The Directors of the Wellingborough Gas Light Company, Ltd., have filled the vacancy caused by the death of Mr. J. T. Lewis, the late General Manager of the Company. The duties of the office have been divided, Mr. A. S. CAMPBELL, F.C.I.S., the Secretary, becoming also Commercial Manager, while Mr. C. C. WOOD, Assoc.M.I.Gas E., who was Mr. Lewis's assistant for a number of years, has been appointed Engineer.

* * *

Mr. CHARLES H. UNDERHILL, Chief Chemist at the Burton-on-Trent Gas-Works, has been appointed out of six candidates to the newly-created post of Distribution Manager.

OBITUARY

LUKE BUNCH TAYLOR.

The death occurred suddenly, on Nov. 14, at his residence, "The Laurels," Wellington Road, Dudley, of Mr.

THE LATE MR. L .B. TAYLOR.

LUKE B. TAYLOR, aged 64 years. Mr. Taylor was a Director of Meters, Ltd., of Manchester, and for 36 years was Senior Representative of Messrs. J. & J. Braddock, Globe Meter Works, Oldham. Known throughout the Gas Industry and liked by everyone, deceased will be greatly missed.

An Appreciation.

By G. O. C.

Luke Bunch Taylor has been called from this sublunary abode. It is a very sad thought; on the other hand, surely we are uplifted when we think of his beautiful example and life. By his death a great loss has been sustained, not only by his widow and family, but by his personal friends, of whom there are very many, both in the Gas Industry and locally.

A highly respected representative for many years and a Director of the firm of Gas Meter Manufacturers, Messrs. J. & J. Braddock, of Oldham, he had the faculty for attracting to himself a wide circle of friends. He was welcome wherever he went; his wonderfully genial personality and charm of manner gained him entrée when others probably would have failed.

A believer in high ideals, there was a tenderness about his nature and a quiet and unostentatious benevolence that it would be difficult to achieve, let alone excel. To anyone distressed or in sorrow he was a truly sympathetic friend, which his many acts of kindness and consideration proved. He loved his wife and family, his home, and all that home means, and through his genial and kindly demeanour he was greatly beloved by all who came into contact with him.

He never aspired to municipal honours, but he found other channels of usefulness in his Church and Freemasonry, having been Warden in the Church and Chaplain of one of his three Lodges for some years. He was a Past-Master in three Lodges: Noah's Ark, Tipton; Murdoch, Birmingham; and Northern Star, Manchester. He was also a Past Provincial Grand Deacon of Staffordshire.

When we think of Luke Taylor we are immediately lifted up, strengthened, and encouraged to emulate his splendid example. His indomitable cheerfulness notwithstanding his great disability, which was ever with him, and gave him little respite, was truly wonderful.

He was ever mindful of the words of Thomas Hardy:

"If you think, have a kindly thought.
If you speak, have a kindly word."

* * *

W. DOIG GIBB.

We hear, with deepest regret, that Mr. W. Doig Gibb died this morning.

* * *

The death took place in Belfast, on Armistice Day, of Mr. WM. P. ALLEN, who two years ago retired from the Belfast Gas Department after 56 years' service. Mr. Allen, who was Prepayment Meter Superintendent and Chief Inspector, served under three Managers—Mr. James Stelfox, Mr. A. Sharpe, and Mr. J. D. Smith. He was the first apprentice appointed after the Gas Undertaking came under the control of the Corporation in 1874.

CORRESPONDENCE

The Growing Popularity of "Coalite."

SIR,—I do not usually take much notice of controversial statements in the Press, but in your issue of Nov. 15, p. 520, there are quoted some remarks made by Dr. G. E. Foxwell, in the course of the discussion on a paper on cokes, to which I feel bound to reply.

Dr. Foxwell, according to the report, charges me with "seizing upon remarks of Dr. Smith to boost 'Coalite.'" Why, I wonder, does he consider it necessary to be so rude? I did not "seize" upon any remarks. They were uttered at a public meeting duly reported in the Press, and I copied the remarks accurately from the "GAS JOURNAL" issue of Oct. 25, p. 271. And why the somewhat vulgar and incorrect use of the word "boost"?

As the Chairman of Doncaster Coalite, Ltd., it was both usual and proper that I should report to the shareholders the increase in the trade of the Company and what the public generally thought of the fuel. The best method of explaining this was by quoting the public statements of an acknowledged authority, and one, moreover, who apparently had taken the trouble to ascertain the truth by a long period of experimentation.

It is further quite obvious that Dr. Foxwell does not like the results of this work, because he goes on to say that Dr. Smith did not mean what he said. It would be interesting to know what justification there is for this wild statement.

To those of us who know the sincerity and accuracy that characterizes the technical contributions of Dr. Smith, the remark appears utterly ridiculous.

Finally, Dr. Foxwell himself said that he felt "there is a movement on foot which is expanding more and more and creating a demand for solid smokeless fuel." Exactly—and this "movement" has derived its material strength from the progress made by "Coalite," and for the very reasons given by Dr. Smith.

Yours, &c.,

THEODORE INSTONE,

Vice-Chairman, Askern Coal and Iron Company, Ltd.; Chairman, Doncaster Coalite, Ltd.

52-54, *Leadenhall Street,*
London, E.C. 3,
Nov. 17, 1933.

Theory of Industrial Gas Heating*

A Timely Publication

In view of the widespread interest which is being devoted at the present time to the applications of town gas to industrial heating, and the demand for educational works on the subject, we are pleased to be able to announce the publication this week of a book under the above title.

It is the proud claim of the Gas Industry that town gas is used in every conceivable trade and industry, and that the number of different processes which gas carries out is legion. The claim is justified and its implications are far-reaching, for it follows that those engaged in the industrial application of town gas must be prepared to deal with an infinite variety of problems covering the widest possible range of temperatures and conditions. They must be able to tackle such widely different heating operations as those involved in metal melting, steam raising, calcining and drying processes, and must also be familiar with the technicalities of the processes in question so as to understand their requirements. Under these conditions it is clear that a high degree of technical ability will be required of those engaged in this work.

A Wide Appeal

Furthermore, the technique of industrial fuel application is a rapidly growing subject, and the demands of the modern manufacturer are too exacting to allow of rule-of-thumb methods. In these circumstances no apology is needed for the emphasis which has been laid in this book on the theoretical aspects of gas fuel application, for unless these are understood it will not be possible to develop the use of gas in industry on a sound basis.

The book represents, we believe, the first attempt to work out the general theory of industrial gas application, and it includes information which will be of interest not only to students and salesmen, but also to designers, manufacturers, and users of industrial equipment. It contains, for instance, a summary of essential information on the properties and methods of application of competing fuels such as electricity and fuel oil, and indicates the conditions under which these are most effectively used, subjects which are of first-rate importance to representatives of the Gas Industry.

As a further illustration of the scope of the book, it may be mentioned that it not only gives many formulæ for calculation of gas flow through orifices, flue gas composition, flue loss, &c., but also includes diagrams which show these and other relationships in graphical form. In later chapters the difficult problems of heat transference and thermal efficiency are fully discussed in relation to the design of appliances, and other questions, such as the control of temperature and the effect of atmospheric conditions, are dealt with in detail.

Of the many illustrations those dealing with temperature measurement and control are among the most effective, as they indicate very clearly the mechanism of these somewhat complex devices.

Bound in dark red Rexine, the book contains 104 pages demy 8vo., and the text is fully illustrated with 27 diagrams. A bibliography and table of conversion factors are included for the assistance of the reader, and the text is carefully indexed for ready reference.

Trained Experts Needed

In a foreword to Mr. Lloyd's book, Mr. Stephen Lacey, Controller of Gas Sales of the Gas Light and Coke Company, says:

The publication of this book is very timely, coming, as it does, when the Gas Industry is undertaking the organization of a Regional Scheme involving the setting up of a considerable number of centres which, properly co-ordinated, will be the means of developing the industrial gas load in the areas they respectively serve.

In order that these centres shall serve their purpose effectively, they must be properly staffed with fully trained experts and technical salesmen; and it is for such men that this book is primarily written. Mr. Lloyd's experience at Watson House, where the Gas Light and Coke Company's Industrial Centre is situated, qualifies him to speak with authority, and I hope and believe that this endeavour to formulate a sound theoretical basis for the practical solution of the variety of heating problems that have to be dealt with will be widely circulated and carefully studied in the Gas Industry.

* "Theory of Industrial Gas Heating," by Peter Lloyd, B.A. (Cantab.), A.I.C. Walter King, Ltd., "GAS JOURNAL" Offices. Price 6s. net, post free.

Time and Money will be Saved

H. D. Madden

The prominent position of Cardiff in the development of industrial gas usage is generally recognized, and Mr. Madden, Engineer and Manager of the Cardiff Gas Light and Coke Company, kindly consented to act as reviewer of Mr. Lloyd's book before publication.

I have read with great interest, he writes, the publication entitled "Theory of Industrial Gas Heating," by Peter Lloyd, B.A. (Cantab.).

In the first place, the Industry is again under an obligation to the Governor and Directors of the Gas Light and Coke Company for permitting such valuable data, collected at Watson House, to be published for the benefit of the Industry.

At the present time, with the creation of Industrial Gas Centres throughout the country, the publication of such data is very opportune, inasmuch as the staffing of the Centres referred to calls for men of high technical and engineering knowledge who are now being recruited from the universities, &c.

A great deal of time and money will be saved by the use of this new publication by men entering the Industry in a specialized capacity. The primary application of available fuels—viz., solid, liquid, and gaseous—is dealt with in a straightforward and clear manner. The Properties of Town Gas, the Principles of Combustion, and the Design of Burners for Industrial Operations are among the subjects treated, and they are dealt with in such a way as to make the book an exceedingly valuable one as a guide and reference for the staff now engaged on research work and also industrial gas problems.

Basic principles are clearly outlined, and, while congratulating the author and also the "JOURNAL," I express the hope that this publication may be only the forerunner of future volumes of a similar nature as the knowledge of the work increases.

THE NEWS OF THE WEEK

Chelsea Polytechnic.—The Right Hon. the Viscount Leverhulme will distribute prizes, diplomas, and certificates to students on Tuesday, Dec. 5 next, at 8.30 p.m.

Midland Association.—The Annual Dinner and Dance of the Midland Association of Gas Engineers and Managers will take place on Feb. 5, 1934, at the Grand Hotel, Birmingham.

For the Benefit of Photographers a 6500 c.p. light was installed by the Douglas Gaslight Company in the Court House, in Castle Rushen, Castletown, in connection with the swearing-in of Sir Montague Butler as Lieutenant-Governor of the Isle of Man.

Failures in Cast-Iron Mains.—The Council of the Institution of Civil Engineers have awarded the Coopers Hill War Memorial Prize for 1932 to Mr. E. F. Reid, M.A., Assoc.M.Inst.C.E. (Oxford), for his paper on "Failures in Steel and Cast-Iron Mains and provision for their Protection." This Prize was founded by the Coopers Hill Society in memory of Coopers Hill men who lost their lives in the war.

At The Request of the Watford and St. Albans Gas Company, Mr. H. C. Wild, Joint Manager of the Veritas Incandescent Mantle Works, gave a lecture on Oct. 24 in connection with the manufacture of gas mantles, also gas lighting, including burners. The lecture was attended by the staff and employees of the Gas Company and was given in the Lecture Hall at the Showrooms, The Parade, Watford.

The November Issue of "Links," a publication issued by Messrs. Alexander Duckham & Co., Ltd., in the interests of users of lubricants, contains a short description of the Beckton Works of the Gas Light and Coke Company, together with an informative article dealing with the oil filming of gasholders, which includes details of the Matthews' automatic gasholder syphon, for which the firm have the sole selling rights.

While Demolishing a Gasholder at Broughton Road, Edinburgh, workmen discovered a bottle containing a copy of a newspaper and a letter dated May 12, 1885, stating that the "tank" was begun in March, 1884, that Messrs. Laidlaw, Sons, & Caine, Glasgow, were the erectors, that on account of the nature of the soil the work had proved difficult, and that this was the largest holder in Scotland. Mr. F. T. C. Linton was Engineer and Manager at that period and the owners were the Edinburgh and Leith Gas Company.

Owing to the Continuation of Restrictions upon Exchange, and consequent inability to obtain sufficient sterling remittances from Montevideo, the Directors of the Montevideo Gas and Dry Dock Company, Ltd., have again to express their deep regret that it is impossible to pay an interim dividend for the half-year to June, 1933. The Directors, however, have pleasure in stating that after providing for all losses on Exchange, the results for the half-year show an improvement on the corresponding period of 1932, which if funds had been available would have enabled them to declare an interim dividend.

Liquor Effluents and Ammonia.—Two corrections should be made to our report of the remarks of Mr. P. Parrish, of the South Metropolitan Gas Company, in the discussion on the third report of the Sub-Committee on Liquor Effluents and Ammonia at the autumn research meeting of the Institution ["JOURNAL" for Nov. 15, p. 508]. "Moreover, there is devil liquor . . ." should read "Moreover, there is no devil liquor." Then, on the question of ammonium bicarbonate, "We have to find out how to make it when it is perceptibly volatile. . ." should read "We have to find out how to make it without being perceptibly volatile. . . ."

A First Prize and Cup were won by the Minehead Gas-Light and Coke Company, Ltd., for their tableau car in the Minehead and Alcombe Carnival for the best tradesman's display, together with a first prize for the best lighted tableau. The tableau represented two rooms, the one, dated 1893, illuminated by flat-flame burners depicting a sweep at work on a very sooty chimney, assisted by a servant sweeping up the mess, while the other—a sitting room of the present day, lighted by a "Littleton" lamp and panel brackets—showed a young married couple sitting before a modern gas fire set in a tiled surround. Above the display were brilliant gas lamps, and on the front a slogan "Gas Turns Night into Day."

Future Prospects of Low-Temperature Carbonization.

At a meeting of the Institute of Fuel held at St. Ermin's Hotel, London, on Nov. 14, Mr. John Roberts discussed the question of "What is needed to make the low-temperature carbonization of coal a national industry?" He expressed the view that direct State aid was unnecessary, but the moral support of the Government would be a great help.

He considered that a carbonizing corporation should be formed, having sufficient financial backing to erect plants in every coalfield, of such type and size as to be suitable for the coals available and the proximity of the market. Under such a scheme the plants to be erected should be selected by a committee of technical experts, including one representative of the Fuel Research Board and one from the Coal Owners' Association. The corporation should have a central publicity department and sales organization, together with a research department under its own control. It should keep a close watch on new developments at home and abroad in the treatment of coal and its derivatives, and any process warranting trial should be thoroughly tested.

National Gas Council.

Meeting of Central Executive Board.

A Meeting of the Central Executive Board of the National Gas Council was held in the Board Room, at 28, Grosvenor Gardens, London, S.W. 1, on Tuesday, Nov. 14—Sir DAVID MILNE-WATSON, LL.D., D.L., in the chair.

Membership of the Board.—It was reported that Col. H. K. Stephenson, D.S.O., LL.D., J.P., Chairman of the Sheffield Gas Company and President of the British Commercial Gas Association, had been appointed by that Association as one of their representatives to serve on the Central Executive Board.

Coal Utilization Council.—The negotiations which had taken place with the Coal Utilization Council, with regard to those matters on which a common policy existed between the two industries, were reported.

Establishment of Gas Development Centres Throughout the Country.—It was reported that ten Development Centres had been established throughout the country for the purpose of promoting the use of gas for industrial and commercial purposes. Some 240 undertakings representing 72% of the total make of gas for England and Wales had notified their desire to support these Centres.

Claims from the Inland Revenue for Income-Tax on Assistance Received Under the Development (Loan Guarantees and Grants) Act, 1929.—It was reported that a large number of gas undertakings had called the attention of the Council to claims made upon them by their local Inspectors of Income-Tax for the payment of tax in respect of unemployment grants assistance, and that the

Inland Revenue had requested the Council to meet them in order that the subject might be discussed.

Federation of British Industries.—Mr. Chas. F. Botley and Mr. T. Hardie were re-appointed as members on the Grand Council, Main Group 9, Section 1 (Chemical Fertilizers and Explosives), and Sir Francis Goodenough, Mr. H. C. Smith (Tottenham), and Mr. L. E. Clift were re-appointed as members on the Grand Council, Main Group 14, Sub-Group 3 (Public Utilities).

Manchester District Association.

A Joint Meeting of the Manchester District Association of Gas Engineers and the North-Western Section of the Institute of Fuel will be held on Wednesday, Nov. 29 at 6.30 p.m., at the Engineers' Club, 17, Albert Square, Manchester, when a lecture on "Solid Smokeless Fuel" will be delivered by Dr. E. W. Smith, C.B.E.

The chair will be taken by Mr. G. Dixon, B.Eng., Assoc.M.Inst.C.E., President of the Manchester District Association, who will be supported by Mr. E. Watson Smyth, Chairman of the North-Western Section of the Institute of Fuel.

The lecture will be followed by a discussion.

The Importance of Science in Industry.

At the Town Hall, Hastings, on Wednesday last, Dr. C. H. Lander, C.B.E., of the Imperial College of Science and Technology, South Kensington (formerly Director of Fuel Research), delivered an address on the "Importance of Science in Industry."

The occasion was the annual prize distribution of the Hastings Municipal School of Science. The chair was occupied by Mr. Chas. F. Botley, Engineer and General Manager of the Hastings and St. Leonards Gas Company.

In the course of his address Dr. Lander showed how the methods of industry followed during the industrial revolution in England were giving way necessarily to new ideas; it was to the coming generation that they must look for progress in the direction of a greater appreciation of the value of science in its application to industry.

A Lecture on Gas Meters.

The first of a series of six lectures to the outdoor staff was initiated on Nov. 17 at the chief showrooms of the Sheffield Gas Company, when an attendance of almost 90 employees assembled to hear Mr. A. W. Sharman, Chemist and Lecturer to Messrs. Thos. Glover & Co., Ltd., Gas Meter Manufacturers, London, deliver his lecture on "Gas Meters."

A most instructive evening was spent and the cinematograph display showing the lay-out of the meter works at Edmonton, the stamping, preparing, and assembling of the material necessary in the construction of gas meters of all kinds, was followed with great interest.

Mr. Sharman prefaced his remark by a brief survey of the improvements in gas meters since they were first invented.

A keen discussion took place at the conclusion of the lecture.

Watford and St. Albans Gas Company.

Amalgamation with Rickmansworth Undertaking.

An Extraordinary General Meeting of the Watford and St. Albans Gas Company was held at the Company's Chief Showrooms at 149, The Parade, Watford, on Tuesday, Nov. 7 last, in connection with the amalgamation of the Company with the Rickmansworth Undertaking.

Mr. Frank H. Jones (Chairman and Managing Director) was in the Chair, supported by Messrs. Henry Brown, R. T. Kent, C. Chambers, H. N. Lipscomb, H. F. H. Jones (Directors), G. Wilks (Secretary and Commercial Manager), T. S. Godwin, T. C. Battersby, and H. C. Dunbar (Works Managers).

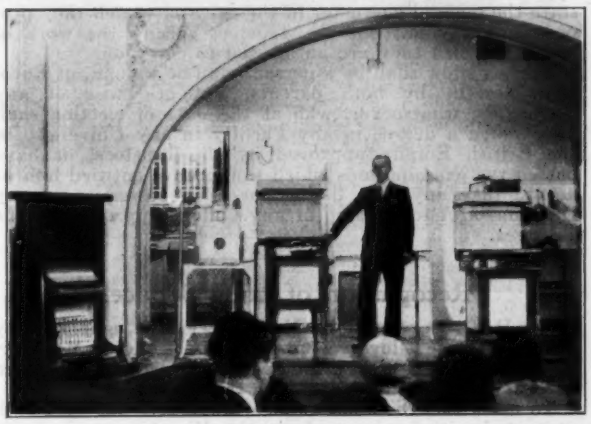
The Chairman, in moving the approval of the Agreement to acquire the Rickmansworth Gas Undertaking, referred to the fact that a bulk supply had been afforded to the Rickmansworth Council for the supply of gas by them since 1917, and that a twenty-one years' agreement for the total gas requirements of all consumers in their area of supply was entered into in 1924. It was thought to be in the interests of both the Watford and Rickmansworth concerns that a complete amalgamation should take place.

Since 1929 the former Watford Gas Company had amalgamated with St. Albans, Elstree, Hempstead, Welwyn and Hatfield, and Harpenden, and all these Companies, together with Rickmansworth, would now be under one control. The proposed transfer was subject to approval by the Board of Trade and both Houses of Parliament and would date from March 31, 1934.

Mr. Henry Brown (Deputy-Chairman) seconded the resolution, which was carried unanimously.

The Chairman then proposed that application be made to the Board of Trade for a Special Order to confirm the above Agreement and to increase the capital and the borrowing powers of the Company, and to confer further powers on the Company. This was also seconded by Mr. Henry Brown and carried unanimously.

An Eastern Demonstration.



Ancient history has associated wise men with the East, but the introduction of the "New World" cooker to that part of the Globe, and the sales which have followed, reveal the fact that Eastern women also have a claim to this distinction. Our illustration shows Richmonds "Bungalow" "New World" cooker being explained before an audience of women in a large city in the Near East, where the housewives share the advantages of "Regulo-Controlled" cooking with their sisters of the Western World.

Progress of Industrial Gas in Australia.

If the experiences of the Australian Gas Light Company, Sydney, during the past year form any indication of the general trend of industrial applications of gas throughout the Continent, it may be assumed that the industrial gas load in Australia is definitely on the upward path—and this in spite of the effects of the depression which are still with them.

Commenting on the progress of the industrial side of their business, the Chairman, Mr. A. Consett Stephen, mentioned at the ninety-fourth annual meeting of the Company, that the sales of gas for this purpose amounted to 559,257,800 c.ft.—an increase of 23·5% on the previous year's figures. At the present time the quantity of industrial gas sold by the undertaking amounts to 9% of the total output. It is interesting to note that one industrial consumer alone used no less than 73,627,000 c.ft., which is roughly equivalent to the consumption of 3032 of their average domestic consumers.

The Company have during the past year completed the installation of a large steel tube welding furnace, consuming gas up to 12,000 c.ft. per hour. In another instance a biscuit manufacturing company who are modernizing their plant have a large gas-fired oven on order from Britain for installation in new premises. This oven will use 2000 c.ft. of gas per hour, and its purchase was decided upon only after very exhaustive investigations into the merits of competitive methods of heating. Inquiries are constantly being made and propositions developed for the application of gas to new processes, an interesting instance in this connection being the recent completion of a plant by one of Sydney's leading radio equipment makers for the manufacture of radio valves. Gas is utilized in practically all the processes on this plant, and the recent extensions resulted in a consumption of about a third of a million c.ft. per annum.

THE NEWS—continued.

Beit Fellowship for 1934.

Applications for the Beit Fellowships for Scientific Research—which were founded and endowed by Otto Beit in 1913 " to promote the advancement of Science by means of Research "—must be received on or before April 12, 1934. Copies of the Conditions of the Award and the Form of Application may be obtained by members or the research staff of the Institution of Gas Engineers from the Secretary of the Institution at 28, Grosvenor Gardens, London, S.W. 1.

Not more than three Fellowships, each of the annual value of £250 and tenable for a period of two years, will be awarded on or about July 13, 1934, to candidates, under the age of 25 years, who " are of marked promise and are likely to become researchers above the average."

The Beit Scientific Research Fellows work for the whole of their time under the supervision of a Professor of a Department of the Imperial College of Science and Technology and must not, without permission, take or hold any appointment whether paid or unpaid. Applicants have to state the general character of the research which they propose to carry on, but the Trustees specify the work of research which they are authorized to carry on.

Every Fellow shall be a person, man or woman, of European descent by both parents, but otherwise of any nationality whatsoever, who at the date of election shall have taken a degree in any Faculty in any University in the British Empire approved by the Trustees, or have passed the examinations which would have entitled him or her to take any such degree, or is in possession of any Diploma or Associateship of any College approved by the Trustees.

Recognition of Long Service.

Mr. H. G. Dormand and Mr. C. B. Clarke, employed by Messrs. George Glover & Co., Ltd., Gas Meter Manufacturers, Ranelagh Works, Chelsea, have recently completed 60 years' continuous service with the firm.

To mark this Diamond Jubilee, these veterans were each presented with a cheque from the Directors, and also a mahogany gramophone and cheque from the staff and employees of the firm.

The presentations were made by Mr. C. G. Langford, General Manager, at a meeting of some 300 employees. He stated how glad they all were that Messrs. Dormand and Clarke were still in excellent health, and still able and anxious to take part in the factory life. He read a letter from the Chairman of the Company, Mr. H. M. Thornton, expressing appreciation of the loyal service rendered by these old servants, and that it was by such men that George Glover & Co.'s high reputation had been built up.

London and Southern District Juniors.

Twenty-First Annual Dinner.

The Twenty-First Annual Dinner and Dance of the London and Southern District Junior Gas Association was held last Friday at the Empire Restaurant, Victoria, under the Presidency of Mr. H. C. Sims, Assoc.M.Inst.C.E., of the South Metropolitan Gas Company.

Proposing the toast of " The Association and the President," Mr. E. V. Evans, Joint Manager of the South Metropolitan Company, remarked that he had known their President for a great number of years; he was one of the Engineers attached to the Company Mr. Evans served, and he was one of those Engineers, he was afraid, to whom they gave the most difficult jobs of work to do; but he had never known of a case where Mr. Sims had not successfully carried through that work. He was more of a doer than a talker; he got on with his job and did not come back to the Management when he was in difficulties but only when he had finished. He had also qualified in Civil Engineering before he had qualified in gas.

The Gas Industry to-day, continued Mr. Evans, was experiencing heavy weather, but he had the greatest confidence in its being the finest Industry in the country. During the next few years all members of the Industry had got to pull together to deal with the propaganda which was being started by their electrical friends. The Industry needed all the brains available, and it was the Junior Associations who were going to provide those brains in the future.

Mr. Sims, replying to the toast, said he felt it a great honour, not only to himself but to the Association, that Mr. Evans should be with them on that occasion. He was proud to say that their Association was now the strongest Junior Association in the country: their membership had reached the 450 mark, and it was still likely to grow, which was more remarkable in view of the fact that the rules governing entry to the Association were very stringent—in fact, they were as stringent as those governing membership of many of the Senior Associations. In conclusion, the President referred to the valuable work done by their Hon. Treasurer, Mr. Soar, and by their Hon. Secretary, Mr. Higton, to whose energy, foresight, and tact the success of their Association was in no small measure due.

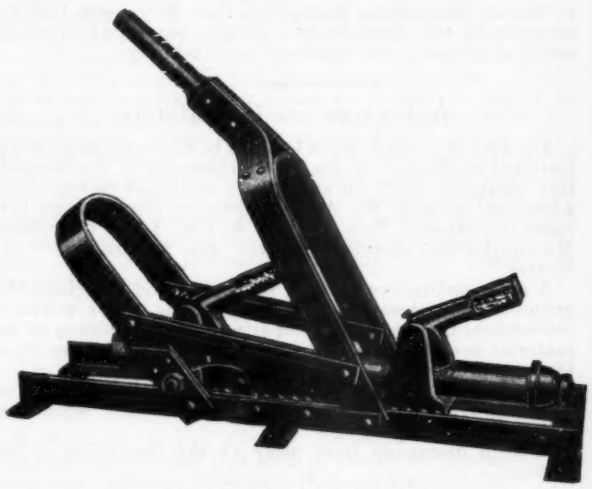
The Senior Vice-President, Mr. F. C. Smith, F.C.S., proposing the toast of " The Visitors," referred to the distinguished guests who were with them that evening—Mr. Evans, Mr. Vince, Mr. J. R. W. Alexander, Secretary of the Institution of Gas Engineers, Mr. W. Grogono, Engineer at Croydon, Mr. R. J. Milbourne, and Mr. Stephen Lacey, Controller of Gas Sales to the Gas Light and Coke Company. The Association were honoured, he said, by the presence of men who were leaders of their Industry.

Mr. Lacey, responding to the toast, thanked the Association for their hospitality and remarked how glad the Senior Associations were to have the support of the Juniors.

NOTES ON PLANT AND PROCESSES

The "Skylux" Pipe Pusher.

The " Skylux " pipe pusher, manufactured by Messrs. Skylux, Ltd., of 22, Great St. Andrew Street, London, W.C. 2, is a useful machine designed to lay pipes up to 2 in. diameter from cellars to street mains, &c., while it will push metal pipes under railways, paved streets, lawns, hedges, and so forth without disturbing the surface. It will in addition drive out old pipes and replace with new, being operable by unskilled labour. An enlarging head can be fitted for laying pipes up to 4-in. diameter.



The "Skylux" Pipe Pusher.

The method of operation is as follows: See that the machine is securely anchored and as near as possible to the bank through which it is intended to push and perfectly in line with the point to which it is required to push the pipe. Usually the most effective method is to bolt down the machine on to two planks. Thus mounted, the machine is raised slightly from the ground level, and this minimizes the possibility of dirt getting into the ratchets. It is important that this should not occur. Where soil conditions are favourable the machine can be held by stakes driven into the ground at the rear of the cross arms. Fix a standard reducer and plug (say $\frac{3}{8}$ in.) to the front end of the pipe; adjust the machine to grip the size of pipe to be pushed by using as many of the flat adjustment plates under the jaws as may be needed to raise the pipe high enough to be gripped securely by the upper jaw when this is sloping at an angle of about 15°. Slip the pipe through the machine until the plug strikes the bank through which it has to push and then draw the carriage back to the rear end of the bed.

The machine is now set ready for the actual pipe pushing operation, and the working of the handle forward and back forces the pipe through the ground.

BOSTON—"AND SO TO ENGLAND."

WITH THE INSTITUTION DELEGATES.

BY THE EDITOR.

The Old State House at Boston.

Our last stay on American soil was for one night at Boston, before starting, on Sunday afternoon, Oct. 8, upon the return journey to England. We had travelled overnight from New York, but were perfectly fresh, and ready for new adventures, when, early on the Saturday morning, we were met by Mr. W. C. Beckjord, Vice-President of the Boston Consolidated Gas Company—who was Chairman of a General Committee, including the officers of the New England Gas Association, and of the Guild of Gas Managers of New England, who had been appointed by the President of the former Association, Mr. H. R. Sterrett, to receive the visitors. After breakfast Mr. Beckjord was introduced to us by Mr. Sterrett, who, with other friends, had met us on arrival at the railway station; and thereafter we proceeded to inspect the Everett bye-product gas plant.

No offence will be taken by anyone, if it is remarked that in some ways Boston appeared to be the most "English" of any of the United States cities visited by us. But it resembles others in the pride shown in the possession of "the largest"—something or other. This is quite appropriate, seeing that Boston is the business, industrial, and population centre of New England. There is expansiveness everywhere in North America—from the hearts of the people to the view from an elevated position. But in spite of being so used to thinking largely, feeling largely, and seeing largely, the inhabitants of every city are always proud to have in their own community some particular thing, or things, to which they can point as being "the largest." We saw many of these largest things in the course of our journeyings. To mention only two—we stayed in the largest hotel at Chicago, and we saw the tallest building in the world at New York. Boston, however, has quite a number of claims in this respect. Here are some: Boston, which is the fourth city of the United States, with a population of practically 2 millions, has the largest wool storage warehouse in the world; the largest fish freezing and cold storage plant in the world; is the largest centre and market of the allied shoe and leather industries in the world; and is the home of the largest safety razor manufacturing plant in the world. Then, of course, there is the celebrated Harvard University, which is said to be the oldest and most distinguished school of learning in America. The State of Massachusetts was only a few years old when she founded this famous University.

Steeped in History.

Thus Boston is great as a centre of modern commercial activity, while withal it is steeped in history. Boston is proud of her past, as she is proud of her present.

The very warmth of our welcome on reaching New England should, by contrast, have taken our minds back to that cold December day in the year 1620, when, as described by John Finnemore, "a small ship appeared off the New England shore and beat up and down the bleak, wintry coast, searching for a landing-place. Over her bulwarks peered the faces of men, women, and children, looking eagerly at the new country which was to be their home. Only a few hostile Indians saw them land; but those Indians looked upon one of the greatest events of history, for the little ship was the immortal 'Mayflower,' and she bore on her decks the ever-famous Pilgrim Fathers of America. The Pilgrim Fathers landed at a spot which they called New Plymouth, after the English port from which they had sailed. They stepped ashore upon a huge boulder which is kept to this day, and is looked upon with reverence as the Pilgrims' Rock."

Again, let us leave modern Boston, and try to imagine the district as it was 160 years ago, when, in December, 1773, there were moored to Griffin's Wharf three British ships with cargoes of tea. We visited the spot, where there is a tablet marking subsequent events, which are thus recorded: "To defeat King George's trivial but tyrannical tax of threepence a pound, about ninety citizens of Boston, partly disguised as Indians, boarded the ships, threw the cargoes—342 chests in all—into the sea, and made the world ring with the patriotic exploit of the Boston Tea Party. No! Ne'er was mingled such a draught in palace, hall, or arbor, as freemen brewed and tyrants quaffed that night in Boston Harbour."

From Boston to Lexington is the road taken in April, 1775, by Paul Revere and William Dawes, when they rode to warn the inhabitants of the approach of the British soldiers; and it was at the latter place that the leader John Parker issued the historic command to the handful of men who were with him: "Stand your ground. Do not fire unless fired upon; but if they mean to have a war, let it begin here." The spot is marked by a boulder bearing this inscription. And at Concord Bridge close by firing took place, which preceded that retreat of the British to Boston, about which so much has been written.

There is to be seen the Old State House, from the balcony of which were proclaimed the Declaration of Independence, the Repeal of the Stamp Act, and the declaration of peace with England. At one time the building was used as the headquarters of the British Army in Boston. A prominent feature in the landscape of Charlestown is a granite obelisk over 200 ft. high, within the lines of the American redoubt which was the centre of the Battle of Bunker Hill, in 1775.

After luncheon in the Parker House, as the guests of the New England Guild of Gas Managers and the New England Gas Association, at which the British Consul was present, we had the choice of witnessing a Harvard-Bates Football Match or of going for a drive to the celebrated Wayside Inn, at Sudbury, which is regarded as the scene of Longfellow's "Tales of a Wayside Inn." It was built 250 years ago, and for many years was a tavern. Now it is the property of Mr. Henry Ford. Those of the party who selected the latter alternative enjoyed a drive through delightful scenery, and passed many of the spots to which reference has been made above.

Everett Bye-Product Gas Plant.

Our journey to the Everett Bye-Product Gas Plant, belonging to the Massachusetts Gas Companies, was by one

of the remarkably efficient diesel-electric tugboats, which have become so popular in the United States. This type of boat is certainly powerful and under perfect and easy control, and the one we boarded was spick-and-span as a yacht. Landing at the works (which are laid out over 320 acres), we found alongside a steam collier, and learned that the coal handling plant is capable of dealing with a 7000-ton ship in one tide, so that it can leave on the next.

The Everett plant is an extremely interesting proposition, as is shown by particulars embraced in a booklet bearing the title "A Story of Twenty-Seven Years of Progress and Achievement," published in 1929. The Massachusetts Gas Companies were organized in September, 1902, when the first unit (the New England Gas and Coke Company) was taken over. Under this Company's control were the Brookline Gas Light Company, the Dorchester Gas Light Company, the Jamaica Plain Gas Light Company, and the Massachusetts Pipe Line Company, which served as the connecting links between the New England Gas and Coke Company and the other controlled gas companies which it then owned, or might supply with gas in the future.

The construction of the Everett bye-product coke oven plant as a central source of gas for these Companies followed immediately. Both the location and design of this plant reflect the foresight of the management. Its situation on the Everett peninsula, easily accessible to both rail and ocean transportation, has contributed much to the success of the Company's enterprises.

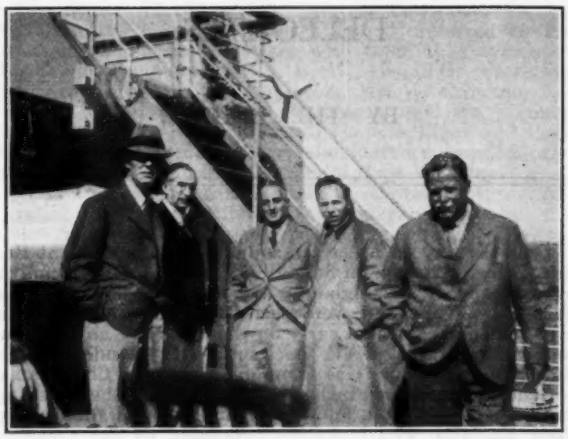
The integrated activities of the Massachusetts Gas Companies progressively develop the story of coal and of coal products. Coal, the basic raw material, is produced from the Company's mines, transported in the Company's ships, discharged at their own terminals, processed in their coke ovens, from which a bye-product is the gas distributed by the Boston Consolidated Gas Company, which also manufactures gas directly from coal and coal products. Coke, as a product of the coke oven operation, and coal, as mined, are marketed by the subsidiary companies which act as sales agents.

For the manufacture of gas and coke, the Everett oven plant uses more than a million tons of coal per annum, most of which is from their own mines. Their own plant requirements and the demand created by an extensive sales force assure continuous operation of the Company's mines, which promotes economy and gives steady employment to a multitude of mine workers. By thus linking production with distribution, the Massachusetts Gas Companies feel that they are contributing much to the solution of the difficult problem of coal mining.

The Everett location is unusual, and ideal for its purpose. On tidewater, with two railroad connections, its shipping facilities, both by water and by land, are unsurpassed. Its principal production is New England Coke, for domestic, foundry, and industrial use, which has earned an enviable reputation for uniformly dependable quality.

One of the most striking features of the industrial development at Everett is the great railroad yard system for handling coal and coke. This private railway system is the most complete in New England, dealing with more public cars than many public railroads.

Another development of the Everett peninsula was inaugurated in 1920, when the Massachusetts Gas Companies were the principal participants in the organization of the Beacon Oil Company, which occupies about 100 acres of the site. A modern oil refinery was built adjacent to the fuel company's plant, where crude oil brought in by tankers was refined for sale through a subsidiary.



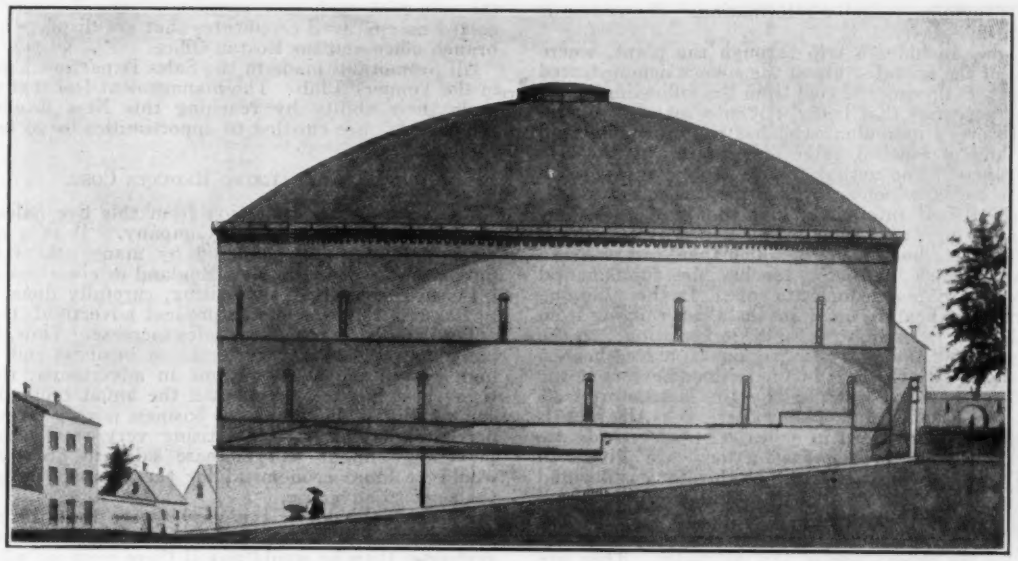
Good Sailors All.

From left to right: Messrs. A. H. Lymn, B. R. Parkinson, C. H. Hunt, D. B. Parkinson, and H. J. Toogood.

Boston Consolidated Gas Company.

Although the Boston Consolidated Gas Company was not incorporated until June, 1905, its inception really dates from the years 1902 and 1903, during which the Massachusetts Gas Companies acquired eight constituent Companies serving most of the Metropolitan District. The acquisition of these Companies brought to an end an unsatisfactory period of active competition by several companies in the same territory, with its uneconomic duplication of manufacturing plants and distribution systems. Subsequently the Massachusetts Gas Companies acquired control of the gas companies supplying various other dis-

AIRPLANE VIEW OF PLANTS OF MASSACHUSETTS GAS COMPANIES AT EVERETT.



THE OLD HULL STREET, BOSTON, GASHOLDER, 1855.

At this time the Boston Gas Light Company served about 6000 customers. The price of gas was $5 per 1000 c.ft. *plus* meter rent.

tricts, and in 1922 consolidations were effected, adding these districts to the system.

The Service Side.

On the service side, the Boston Gas Company show every sign of the activity which we had noticed elsewhere. In the course of these articles, the writer has remarked more than once upon the outstanding efficiency of this branch of gas supply in both Canada and the United States, and what has been said already on this subject may be accepted as applying equally to Boston.

Included in any consideration of the service side must be the training of employees, and here, also, Boston well deserves the attention drawn by Col. Carr at the recent Autumn Research Meeting of the Institution of Gas Engineers to what is being done there, as well as in other cities in America, with regard to the education and training of young workmen. This is what Col. Carr said:

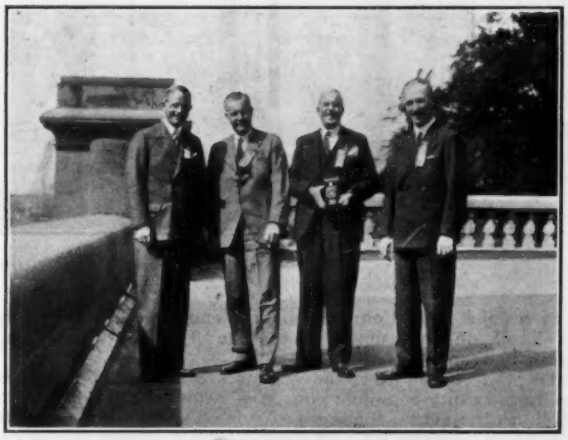
A Model Gas-Works for Training.

> I was very much impressed with the system of the Boston Gas Company in America. They had a model gas-works set up in the schoolroom for gas fitters, and they commenced teaching their fitters the principles of gas manufacture. I thought it was extraordinarily sound. When they have taught the fitters the elementary principles of gas manufacture they go on to the question of utilization. We have a good deal to learn from America so far as systematic education is concerned, and the gas undertakings there—I am speaking generally now—are paying much closer attention to the education of their young workmen than we are in this country; and I think it is one of those points that we have learned while in America and in regard to which many of us will desire to emulate them to some extent. Particularly does it apply to the training of gas fitters. I venture to say that today 90%, almost 99%, of the gas fitters who are visiting our consumers' houses, and who are the main arteries connecting the blood stream of our undertakings with the users of gas, do not know anything about the material they are handling other than that it is gas, and that they have to connect up the pipes to the undertaking; they know perhaps how to use the apparatus. A little knowledge of the constituents of gas and how gas is made would be enormously helpful to them.

The Ingredients of Success.

The following quotations from a "Manual for Salesmen," issued by the New England Coke Company, will suggest the lines that are followed in this branch of training at Boston. The quotations are from the foreword to the manual, written by the General Sales Manager (Mr. R. P. Tibolt):

> The principal ingredient of success is work. Yet to say that some men fail because they do not work hard enough may not be fair. More accurately, they fail because they do not realize that work does not consist of physical effort alone. You may work hard, but unless you strengthen it by the application of your entire mind, ability, and loyalty to your job you are not getting the most out of your opportunities. In other words, the wisest of men would make relatively little progress if he did not apply himself constructively to his job. And constructive application in turn would be of little use without a clean, fair, and sincere attitude toward his customers and prospective customers. Engaged as you are in the profession of salesmanship there is literally no limit to your opportunity.
>
> Yet you must bear in mind always that the people to whom you sell are not interested in you, or in the New England Coke Company, and rarely in the product you are selling. They are interested in their family welfare. Specifically, they are interested in keeping their homes warm and comfortable at the lowest expense and with the least amount of effort. Both points of view—yours and your customer's—are important to your success.



A Quartette from Nottingham.

From left to right: Messrs. R. P. Chester, F. Mitchell, G. Dixon, and T. Carmichael (now of Portsmouth).

A Coke Sales School.

For those who have become its sales representatives, the New England Coke Company conducts at Everett a Research Bureau and Sales School. It is desired that every salesman be a competent service man as well, and it is for this reason that the Company offer the combined sales and research course. The Research Bureau was instituted to educate and help the sales force and the representatives of

dealers, by providing valuable information. The course is completed in five days.

The first day includes a trip through the plant, where every detail of the manufacture of the coke is demonstrated step by step. Following the coal from the unloading wharf through the processes that transfer it into coke is a liberal education to every individual who has the opportunity to witness it, and of especial value and interest to those in the fuel business. The actual coking process in Wilputte and Koppers ovens, which transform the crushed, purified, and pulverized coal into coke, and the five other bye-products, is an impressive sight. This trip provides a basis for the use of the schoolrooms, of which there are two. In one an experienced instructor teaches the fundamental facts about New England domestic coke. In the adjoining room a number of heating units are installed, ranging from the old-fashioned railroad stove and kitchen range, to the sectional boiler and the most modern magazine feed heater.

On the second day the fires in the various heaters in the demonstration room are operated by the instructor, tests are made for fusions and fusing periods. All fuel is weighed before being placed in a heater, time records are carefully kept, and proper instructions are given in draughting and fuel combustion. The third day is devoted to instructing the students in the actual handling of all types of heaters; allowing them to operate the various types of heaters above mentioned. The students operate the heaters under the supervision of the instructor. They are carefully advised on the use of checks and draughts, and shown the effects of using the various methods of controlling a coke fire. Combustion problems are then taken up in detail, and instruction in the use of the pyrometer and other instruments is given.

STORAGE PLANT OF MODERN CONSTRUCTION.

On the fourth day the students start to operate the heaters, taking complete charge of running the fires. This includes the actual fueling, stoking, cleaning, and complete operation of each type of heater. This experience is extremely valuable from a service standpoint. Classroom instruction occupies the balance of the fourth day. This discussion includes the various types of heaters—namely, hot air, hot water, steam, vapour, and vacuum systems.

During the four preceding days a careful record has been kept of all fuel put into these heaters, and on the fifth day the fires are allowed to go out. The ashes are removed from each heater and weighed. The percentage of ash content of the fuel used is taken from all the heaters under the varying conditions through which the test was conducted. This comparison is made by comparing the weights of ash to the number of pounds of fuel fired in each heater.

The Toppers' Club.

In every sales organization there are men whose sales records rise above the average. The Toppers' Club of the Retail Division of the New England Coke Company welcomes those men whose sales records pass the average point. Membership in the Toppers' Club is on a monthly basis. Each member must maintain his daily production to continue. Each member of the Toppers' Club receives a lapel button identifying him as a member. In addition, the name of each new member of the Toppers' Club is posted on engraved certificates that are displayed at every branch office and the Boston Office.

All promotions made in the Sales Department go to men in the Toppers' Club. The management feel that men who show their ability by reaching this New England coke "blue list" are entitled to opportunities to go farther up the ladder.

Advertising Reduces Cost.

And now a final quotation from this live Sales Manual of the New England Coke Company. It is a quotation which may well be pondered by many others than the purchasers of coke—in New England or elsewhere:

Because consistent advertising, carefully done, is likely to increase the sales of the product advertised, the cost of advertising becomes less as sales increase. Thus, if a company does a very small volume of business and spends a high percentage of its volume in advertising, the advertising cost might be high and the amount of advertising small. But if the volume of business is very large and the percentage spent for advertising very small, that small percentage might still increase sales so greatly that it would be more economical for the company to advertise than not to advertise.

By the same logic it is easy to see that the consumer pays a lower price for New England coke because of advertising, than he would pay if there were no advertising. This latter point is emphasized because one often finds unthinking people grumblingly remark that the money used for advertising should be used to make the price to the consumer lower. As a matter of fact, if the money that the New England Coke Company spends for advertising were applied to the consumer price, it would amount only to a very few cents per ton. As a matter of fact, also, production would be so reduced that the per ton price would have to be increased.

[It should be stated that the photographs of the Everett plant, the Boston Gas Light Company's showrooms, and the old Hull gasholder have been reproduced from the booklet "Twenty-Seven Years' Progress" already referred to, while the illustration of the storage plant of modern construction is taken from the New England Coke Company's "Manual for Salesmen."]

On Board the "Georgic."

On a gorgeously bright Sunday afternoon, from the deck of the White Star m.v. "Georgic," we took our last looks at Boston and its magnificent harbour; we were homeward bound! Wild horses could not drag from the writer a confession of preference as between the outward bound and the homeward bound vessels in which we travelled. On each we enjoyed the perfection of comfort and the highest standard of service.

The first thing done by Mr. Alexander when we were snugly aboard was to send telegrams to Major Alexander Forward, of the American Gas Association, and Mr. G. W. Allen, of the Canadian Gas Association, in the names of

BOSTON CONSOLIDATED GAS BUILDING.

This richly finished first floor provides spacious and attractive setting for the display of modern gas appliances.

the President and members of the Institution of Gas Engineers, expressing sincere appreciation of the kindness received during our visit, which would always remain in our memories "as an event of outstanding happiness, which has proved mutually advantageous, and will contribute to the increased prosperity of our countries and the Gas Industry."

During the voyage, Mr. F. J. West exhibited in the saloon, to a delighted audience, the cinematograph films which had been prepared of scenes photographed by him during the tour, and at the conclusion of the display Col. Carr took the chair, and, addressing the President, said they had had a most wonderful tour, exceedingly well organized. All the arrangements had gone like clockwork, and they had enjoyed every minute. Not only that, but they had learned a great deal. They had had full value for the time that they had spent on the tour. Beyond all else, they had established a friendship in the Gas Industry which would doubtless lead to valuable exchange of ideas in the future. They had fulfilled the duties of ambassadors, and the effects of their visit would be felt far and wide. He then asked Mr. T. F. H. Lapthorn, Chairman of the Portsmouth Gas Company, as probably the senior member of their delegation, to make a presentation to Mr. Tarratt, and also to Mrs. Tarratt. Both had been simply marvellous during the tour; they had worked like Trojans.

Congratulations to the President.

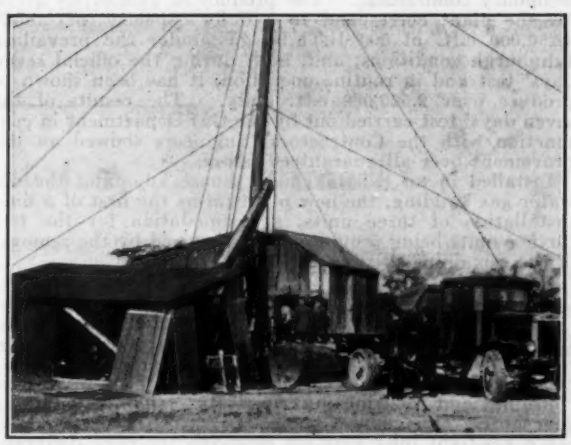
Mr. Lapthorn remarked that they had seen, they understood, many of the biggest things in the world—so many that he had lost count of them; but there was one thing at least in which their recent hosts did not excel their visitors, and that was in the power to appreciate, and the willingness to recognize, true merit where it was found. He had been honoured by being asked to express to the President of the Institution the congratulations of all his fellow travellers on the dignified and able way in which he had represented the Gas Industry of Great Britain and Ireland throughout the whole of the trip. Not once had Mr. Tarratt given them the slightest reason to be otherwise than thankful that they had so efficient a leader. It was a great pleasure to ask Mr. Tarratt to accept from his fellow travellers a silver loving cup suitably inscribed, which, he hoped, would serve as a memento of a delightful time, and as tangible proof that he had been equal to the heavy responsibility put upon him. The cup had been subscribed for by all. He had now the added pleasure of asking Mrs. Tarratt to accept from her fellow travellers a handbag, which, he trusted, would serve as a reminder that her husband owed very much to her for the graceful and charming manner in which she had played her part.

In acknowledging the gift, Mr. Tarratt remarked that he had had to make many speeches during the tour, but the present was the most difficult task of all. Mr. Lapthorn had referred most kindly to what he (the President) and Mrs. Tarratt had done. He had felt himself that the trip had been a great success, and that they had all made good friends. This cup would remind him of the many happy days they had spent together during the tour. In conclusion, he wished to thank Mr. Alexander for all he had done in making the excellent arrangements, for without considerable foresight on his part things could not have gone so well.

Mrs. Tarratt also expressed her appreciation of the souvenir that had been handed to her.

After dinner on the Saturday evening, the President said they all felt that they could not allow the trip to conclude without endeavouring to show in a tangible manner their appreciation of what Mr. Alexander had done. He had proved himself to be a good organizer. He asked Mr. Alexander's acceptance of an envelope, and intimated the desire of the subscribers that he should buy himself what he liked with the contents.

The presentation was acknowledged by Mr. Alexander, who said he felt sure that the tour had given pleasure, and brought knowledge and experience, to everyone who had taken part in it. Also, he believed good had been done for the Industry generally.



Drilling a Natural Gas Well.

Photographed during our inspection of the Haldimand Natural Gas Field, on the way from Hamilton to Niagara.

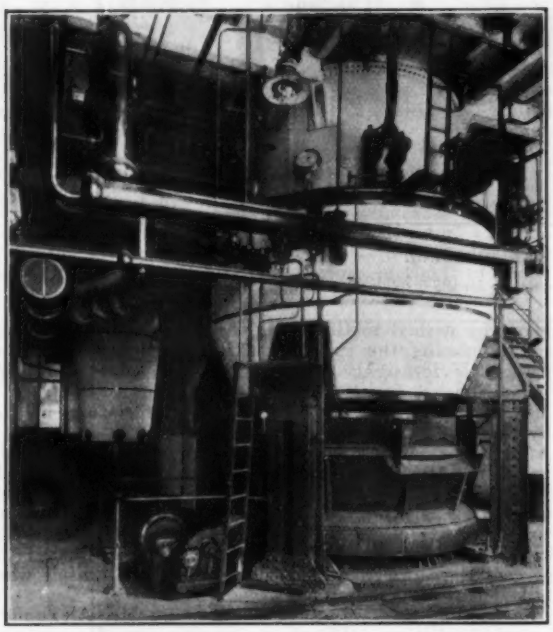
[Within less than forty-eight hours of this last presentation we were all home again, and so this series of articles has drawn to a close. But before finally leaving the subject, the writer would add just a sentence on his own account. These articles have been made possible through the kindness of many friends, in both Canada and the United States, and to all of them his sincere thanks are tendered, for this, and for one other thing—the happy memory of a wonderful tour which will henceforth be his companion on life's road to its end.]

Humphreys-Glasgow Automatic C.W.G. Plant at Edinburgh

New Installation at the Granton Gas-Works of the Edinburgh Corporation Gas Department

The new automatic carburetted water gas plant which was put into operation at the Granton Gas-Works, Edinburgh, in May last is of particular interest in that, besides being the first of its type to be erected in Scotland, it represents the latest development of the Humphreys-Glasgow completely automatic plant.

The plant is self-operating, self-clinkering, self-charging, and self-steaming, and incorporates the back-run process



Self-Clinkering Generator, with Waste-Heat Boiler in background.

and the makers' new system of automatically controlled secondary combustion. The production guarantees given for the plant correspond to a daily capacity of about 2,250,000 c.ft. of 500 B.Th.U. gas under the prevailing Edinburgh conditions; and, both during the official seven days' test and in routine operation, it has been shown to produce over 2,500,000 c.ft. daily. The results of the seven days' test carried out by the Gas Department in conjunction with the Contractors' Engineers showed an improvement over all guaranteed figures.

Installed in an existing boiler house adjoining the old water gas building, the new plant forms the first of a final installation of three units, accommodation for the two further units being provided when required by the removal of the remaining Stirling boiler.

Charging the Machine.

Coke for the plant is raised by means of a bucket elevator to an overhead storage hopper from which it is delivered by gravity down a chute, incorporating a "Cascade" coke screen to remove breeze, to the hydraulic charging and distributing apparatus mounted on the generator. This charger comprises a closed chamber having a gas-tight inlet gate for receiving the coke delivered by the chute, and a gas-tight bottom outlet cone valve discharging into the generator. These gates are hydraulically operated, are controlled by the automatic operator, and are so interlocked that they can never be open together. When the inlet gate is opened a regulated quantity of coke runs into the charger. The inlet gate is then closed, the discharge cone lowered, and the coke discharged into the generator and spread evenly over the top of the fuel bed, which is thereby maintained at constant height and in uniform condition.

The self-clinkering and steam producing generator may be considered as being in two parts—the stationary portion and the rotating ashpan and grate. The stationary portion, which is supported quite independently of the rotating portion upon four massive columns, is also in two parts, the upper part being lined with fireblocks in the usual manner, and the lower taking the form of a low-pressure annular boiler which surrounds the clinker forming zone of the fuel bed, and presents to the molten clinker, which often adheres to and builds up upon firebrick walls, a perfectly smooth and relatively cool surface, thus ensuring its regular descent to the self-clinkering grate.

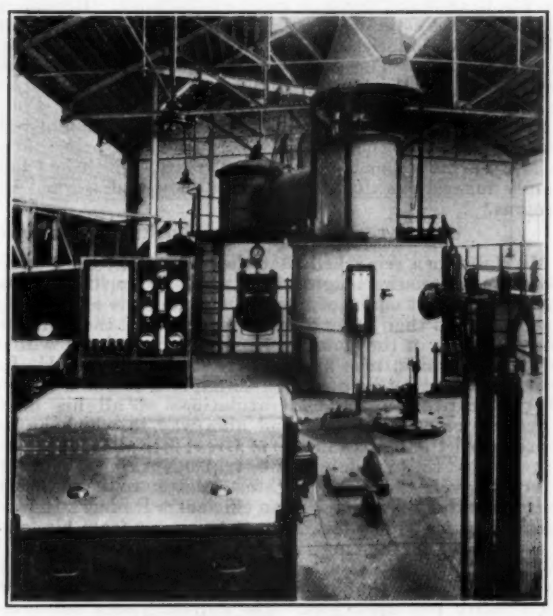
The conical grate is mounted upon a heavily constructed cylindrical drum designed to crush the clinker masses into pieces of size suitable for easy discharge, and both are mounted upon and rotate with the large water-sealed ashpan. A stationary plough effects the continuous discharge from the generator of all ash and clinker to the small rail wagons provided for its reception, this generator refuse being effectively quenched before discharge by passage through the water seal. As a result no labour other than that required to change the clinker wagons is necessary to keep the generator fire in the best condition for gas-making.

The generator is directly connected with the carburettor by means of a firebrick lined conduit containing the secondary air blast diffuser which intimately mixes the secondary air with the combustible blast gases leaving the generator, the secondary air being correctly proportioned to the varying quantity of combustible in the blast gases by a special proportioning device operated and controlled by the automatic operator.

Carburettor and Superheater.

The carburettor is a steel shell lined with fire-blocks and non-conducting lagging, and is partially filled with special checker brickwork which is maintained at the temperature most suitable for the proper gasification of the enriching oil.

The superheater with which the carburettor is directly connected is generally similar to but taller than the carburettor. A suitable off-take pipe for the carburetted gas produced connects the superheater top with the washer, while the hot blast-gases pass through a large firebrick lined conduit from the superheater to the waste-heat boiler. This conduit is provided with a shut-off gate for isolating the boiler when required for cleaning, in which event the



Stage Floor, showing Safety Automatic Operator in foreground, and Superheater and Waste-Heat Boiler beyond.

blast-products pass to atmosphere through the stack valve and smoke stack above the superheater.

The vertical fire-tube waste-heat boiler is of a new type recently developed by the makers, and utilizes the sensible and latent heat in the waste blast-products for the efficient production of high-pressure steam for use in the auxiliary machinery.

A patent "Centriflovane" grit catcher mounted on the

waste-heat boiler smoke stack removes grit from the blast products issuing from the plant.

With the back-run process steam is admitted during part of the gas-making cycle at the top of the superheater, and passing backwards through the heated checker brickwork of the two fixing vessels enters the top of the generator in a highly superheated condition, the resulting back-run gas being conveyed directly from the base of the generator to the washer through a special connection.

The back-run process returns to the fuel bed for use in gas-making heat which would otherwise leave the generating plant in the gas and blast-products; it thus effects considerable savings in fuel consumption and, in addition, increases the capacity of the plant and greatly facilitates the control of temperatures throughout the apparatus.

Automatic Operator.

The automatic operator is an electrically driven machine which, by means of adjustable cams working in conjunction with the necessary mechanism, opens and closes at the required intervals hydraulic pilot valves admitting hydraulic pressure to the cylinders actuating the various working valves of the plant. The necessary hydraulic power is supplied at a pressure of 600 lbs. per sq. in. from the works system.

The following nine valves are in normal operation worked once each cycle by the automatic operator: Generator blast valve, secondary air blast valve, tertiary air blast valve, stack valve, steam working valve, back-run valve, oil working valve, coke charger inlet gate, coke charger discharge cone.

The timing of the valves is readily adjustable to all requirements, and by means of easily accessible gear certain of these valves can be disconnected at will from the operating sequence without the necessity for stopping the operation of the plant, thereby affording complete flexibility of control.

Probably the most important feature of this automatic system is the safeguard against possible irregular movement of the operating valves. In the event of any working valve failing to complete its proper movement or moving too slowly, the gas-making cycle is stopped, and all valves, except that which has failed, are immediately brought to their safe normal position, and at the same time the plant supervisor is notified by audible and visible signals of such shutting down. Similarly, the plant is shut down and the supervisor warned should the electric current or the hydraulic pressure supply fail; in the latter case a sufficient reserve of water pressure to enable the set to be brought to the safety shut-down position is provided by a special hydraulic accumulator.

The provision of the above described safety feature, the elimination of all manual labour, and the necessity for constant attention to timekeeping, makes it possible for one gas-maker to operate two or even three of these automatic plants, thereby greatly reducing the labour charges of the process.

The blowing plant comprises two fan-type blowers, one driven by a DeLaval steam turbine, and the other by an electric motor.

Feed water is delivered to the annular boiler of the generator and to the waste-heat boiler by Weir feed pumps located in the engine room, and is heated by means of a Holden & Brooke exhaust steam feed water heater which utilizes the exhaust steam from the machinery.

The complete automaticity of the plant, which reduces labour charges to a bare minimum, and the high efficiency in gas production resulting from the makers' new processes, effect striking economies in the cost of gas manufacture. Messrs. Humphreys & Glasgow, the makers of the Granton Plant, state that they have extended automatic operation to their plants of even the smallest capacities, and there are now water-gas plants in regular gas-works operation having daily capacities ranging from 70,000 c.ft. of gas up to 6,000,000 c.ft. per unit.

Seven Days' Official Test of the New Plant.

May 9 to 16, 1933.

The following were the observed test results:

Duration of test, continuous working	168 hours
Total gas made, corrected to 60° F. and 30 in. Hg. total pressure	17,732,000 c.ft.
Total gas oil used	35,400 galls.
Average calorific value of gas made	502·2 B.Th.U. per c.ft.
Total coke charged to generator	556,500 lbs.
Carbon content of fuel as charged	74·8%
Total steam production by waste heat and annular boilers, from and at 212° F.	1,015,000 lbs.

Average composition of gas made:

	%
CO_2	4·6
O_2	..
C_nH_m	7·8
CO	33·8
H_2	38·6
CH_4	10·4
N_2	4·8

The above figures should be compared with the guarantees given for the plant when working under the conditions of coke and gas quality prevailing during the test, as follows:

	Guarantees for Production and Efficiency.	Corresponding Test Results.	Excess Over Makers' Guarantees.
Gas production per 24 hours under standard conditions of temperature and pressure, c.ft.	2,240,000	2 535 000	13·2%
Calorific value of gas made, B.Th.U. per c ft.	500	502·2	..
Oil consumption, galls. per 1000 c.ft.	2·0	1·996	..
Carbon consumed in generator per 1000 c.ft. gas made, lbs.	28·7	22·88	20·3%

Domestic Use of Bottled Gas in Denmark

M. Smidth, in *Journal des Usines à Gaz*, 1933, 57, 506-511 (Oct. 20), gives an account of the development of the use of bottled gas in two Danish islands. The author, an engineer of the Nykoebing Gas-Works, visited the research laboratories of the Paris Gas Company in the year 1931 and obtained information from Messrs. Pignot and Chappuis as to the French pioneering work in connection with bottled gas.

Though the idea of the distribution of bottled gas in country districts is not a new one, it is mainly the development of motor-lorry transport in recent years which has made the project a feasible one.

The two adjoining islands of Lolland and Falster were specially suitable for the new enterprise. They are connected by a railway bridge and a bridge for vehicular and foot traffic, and the Nykoebing Gas-Works, located in one of the islands, was willing to supply the necessary gas. The two islands have an area of about 700 square miles. The population is 130,000, 93,000 of the inhabitants occupying rural districts and the remainder being concentrated in seven towns, each of which has a municipal gas-works.

The launching of the scheme was preceded by demonstrations throughout the territory, and these were followed by a house-to-house sales campaign. As a result, about 1000 promises of support were obtained. The prices for domestic installations were fixed at 1600, 1800, and 2400 francs (approximately £13, £15, and £20 at par of exchange), and payment could be for cash or by instalments over two or ten years. In view of the likely success of the scheme, a compressor station was erected and the internal carcassing of the subscribers' premises was commenced. In the meantime a number of the promises of support were withdrawn and the number of initial consumers was reduced to 600, though new clients gradually brought the number to the present total of 1000.

The gas, which is supplied directly from the Nykoebing holder to the compressor station by way of a main 820 ft. long and 6 in. in diameter, has a calorific value of 500 B.Th.U. per c.ft.

The compressor has the following characteristics. Two cylinders for each of the three stages; speed, 320 r.p.m.; piston stroke, 5·5 in.; diameters of the cylinders, 5·7, 5·1, and 1·2 in. respectively; capacity, 2650 c.ft. of free gas per hour. The compressor is fitted with serpentine coolers and oil separators at each stage. Each cooler has a pressure gauge and safety valve, and the cooling water is supplied by a special pump. The compressor is motor-driven with a belt drive and takes 7·4 kw.-h. per 1000 c.ft. of gas compressed per hour. The maximum power consumption measured at the poles of the motor is 17 kw.-h. The power required for compression up to 200 atmospheres is 18·5 kw.-h. Twenty gas cylinders can be connected to the compressor outlet, ten being filled while the remaining ten are being removed and replaced. An arrangement of three valves enables the filling operation to be effected without interruption of the compressor. Charging is effected by

filling ten of the cylinders with gas to a pressure of 150 atmospheres. These are then allowed to cool while the other ten cylinders are charged to the same pressure, and are then charged to 200 atmospheres. Payment for the gas is made to the gas-works on the basis of the number of cylinders charged. Meters were employed at first, but proved unsatisfactory owing to the pulsations caused by the compressor.

Each domestic installation comprises two cylinders, copper connections, a distributor fitted with a pressure gauge, a reducing valve, and a rubber tube. The whole output is contained in a sheet steel cupboard fixed outside a wall of the house. The rubber tube forms the connection with the supply pipe to the house.

The cylinders used at first had a water capacity of 1·4 c.ft., and, when charged to a pressure of 150 atmospheres, contained 210 c.ft. of gas. These cylinders weighed 156-165 lbs. each, including the valves. The valves were originally fitted with ebonite seats, but these were rapidly destroyed by the hydrocarbons present in the gas; hence seats of compressed fibre are now employed.

In 1931, cylinders of alloy steel with a water capacity of 1·75 c.ft. were purchased. These are capable of use at a pressure of 200 atmospheres and weigh 128-132 lbs. each, complete with valve and hood. Their capacity is, therefore, 350 c.ft. of gas. In spite of their greater cost, these cylinders are used for the more distant consumers, since the saving in transport consequent on the difference in weight (0·37 lb. per c.ft. of contained gas, against 0·77 lb.) more than compensates for the extra cost, which is soon paid off.

The most important item of the domestic installation is the reducing valve. Several single-stage and double-stage reducing valves were tried, but none of them met all the exacting conditions they were required to fulfil. A special double-stage, patented valve was therefore designed. The reducing valve forms part of a patented distribution device. It is connected to the outlets of the two cylinders and a three-way cock enables connection to be made to either or neither of the cylinders. The position of the swing-over handle of this cock indicates which cylinder is in use at any time. The arrangement enables the carter to connect up a cylinder and open its valve fully, so that it is ready for instant use when the neighbouring cylinder has been emptied. The task of the consumer is thereby simplified. There was much difficulty in finding a suitable pressure gauge, since the gauge is required always to be at work, whereas the gauges normally employed in connection with cylinders of compressed gas are only in intermittent use. However, a suitable gauge was eventually found.

The most distant consumer is situated 44 miles from the works. In Falster, distribution is effected by means of motor-lorries owned by the gas supplier. Each lorry is provided with a rack with eleven compartments, each capable of holding three cylinders. On departure from the compressor station, the lorry is loaded with thirty cylinders and a space is available for three empty cylinders. Falster and the east of Lolland have been divided into six fixed itineraries and on each working day of the week two of these are traversed. Hence each circuit is visited twice a week on definite days. Consumers are provided with green flags to be fixed outside their premises when a new cylinder is required. The itineraries were so planned that a lorry makes a long journey in the morning and a short one in the afternoon. The daily distance covered by a lorry is 62 miles and sixty cylinders are delivered.

The average consumption per consumer is 42 cylinders per annum with a maximum of 4·2 cylinders per month in summer and a minimum of 2·8 in winter. By working 26 days per month, a lorry can serve 375 consumers in summer and 550 in winter. The consumption is less in winter, due to the use of locally cut wood as fuel.

In Lolland, which is larger than Falster, the consumers are more scattered. Distribution is effected there in conjunction with the railway company. Cylinders are delivered from a truck to the various stations three times per week in accordance with requirements, and are distributed to the consumers by a service of lorries organized by the railway company. A fixed fee per cylinder is paid to the railway company independent of the distance.

The normal price of gas in Denmark ranges between 2s. 8d. and 7s. per 1000 c.ft. The bottled gas is supplied at the rate of 6s. 4d. per 1000 c.ft., delivered.

Locomotive Coaling Plant

The accompanying illustration further demonstrates the increased desire for mechanization in industry, and particularly in railway work.

The plant comprises a Locomotive Coaling Plant at Shoeburyness, L.M. & S. Railway, with truck hoist feeding to overhead reinforced concrete storage bunkers which have outlets for coaling direct to locomotives. Special features have been incorporated by the designers, Messrs. Robert Dempster & Sons, Ltd., Rose Mount Iron Works, Elland, Yorks.

The plant consists of a main ferro-concrete structure with winch house located at the top, all four sides of the main structure being vertical.

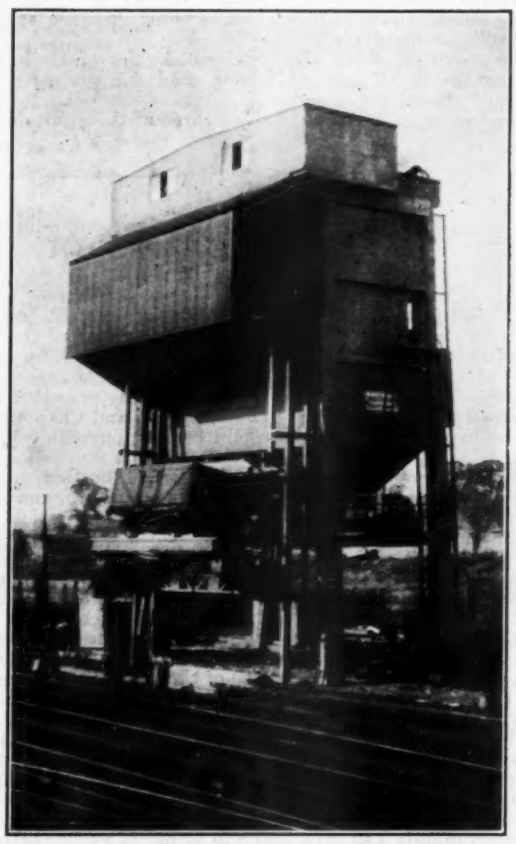
Coal wagons can be hoisted and tipped automatically by means of a Dempster patent side-tipping wagon tipper, running in rolled-steel H-section guides. The hoist is balanced to the extent of approximately the dead weight of the hoist carriage, wagon, and half the load for a standard 12-ton wagon.

The storage bunkers have an untrimmed capacity of 100 tons of coal, and are provided with three outlets, the two outer ones delivering coal to two jigging feeders, each capable of dealing with a variable output of from 12-50 tons per hour, and in addition a central 2-way emergency chute is provided with sliding doors.

The hoist is capable of handling standard railway wagons of from 8 to 20 tons capacity. The hoisting speed is approximately 24 ft. per minute. Current supply: Power, 3-phase, alternating, 400 v. 50 periods. Lighting: alternating 230 v.

The hoist motor is of the totally-enclosed, slip-ring type, 40 b.h.p. at 750 r.p.m. The motors operating the jiggers are each 4 b.h.p. at 930 r.p.m., totally-enclosed, squirrel cage type.

The method of operation is such that after a wagon has been run on to the platform, as soon as the lifting commences, the wagon platform is tilted against the buffer blocks on the cradle; hoisting continues until the top of the wagon comes into contact with the clamping arm, when the whole carriage moves as a complete unit. After the wagon and carriage have been sufficiently hoisted the leading roller of the carriage is caused to be deflected into a horizontal path by the rolled steel joist guide rails, while



The New Coaling Plant at Shoeburyness.

the lower rollers continue in a vertical direction. This produces a turning motion to the carriage, causing the wagon to be inverted in order to empty the contents into the centre of the bunker.

A special feature in the design of the carriage is that, when tipping, the clamping arm is automatically locked in position by a special arrangement of friction pads, which prevent under pressure being imposed upon the wagon sides.

The hoist is operated by a master switch fixed in a suitable control cabin adjacent to the hoist, this switch working in conjunction with an enclosed type automatic air-break contactor controller, fixed in the machinery house adjacent to the motor. To operate the hoist the handle of the master switch is simply moved over to the start position, and switches at the top and bottom automatically limit the travel in each direction.

The process of tipping a wagon by means of this hoist carriage is simple and entirely automatic, and there are no mechanical parts which can get out of order.

The hoisting winch is fixed in the machinery house at the top of the structure and comprises an electric motor, driving through a high-efficiency worm reduction gear on to a countershaft coupled up by means of machine-cut spur reduction gear to the hoisting and balance-weight barrels. An effective electro-magnetic brake is provided and fixed on the motor extension shaft.

The factor of safety in each rope is not less than 6 : 1, and each pair of ropes have compensating gear to equalize the load. Suitable ladders and platforms are provided to give access to the whole of the plant, including the feeder floor, bunker top level, and machinery deck level.

A lean-to hood is provided at the front of the structure to protect the opening over the bunker and prevent the escape of dust.

The maximum capacity of the hoist is approximately 10 loaded wagons per hour of standard sizes between 8 and 20 tons capacity, based on the assumption that an empty wagon can be removed and the next loaded wagon placed on the hoist platform in about 1½ minutes.

The whole of the plant is provided with a number of lighting points for illuminating various portions of the machinery.

At the same Depôt, Robert Dempster & Sons, Ltd., have also installed an ash handling plant.

Opening of Compressed - Gas Filling Station -

The Secretary for Mines Inaugurates Gas Filling Station at the Works of the Chesterfield Tube Co., Ltd.

Another milestone in the progress of compressed gas for motor vehicles was reached at the Works of the Chesterfield Tube Company, Ltd., last Wednesday, when the Secretary for Mines, Mr. Ernest Brown, M.C., inaugurated a public compressed gas filling station, which will for the present serve the requirements of a number of gas-driven vehicles now operating in the Chesterfield district, and will in the future, it is hoped, fill a much wider sphere of usefulness.

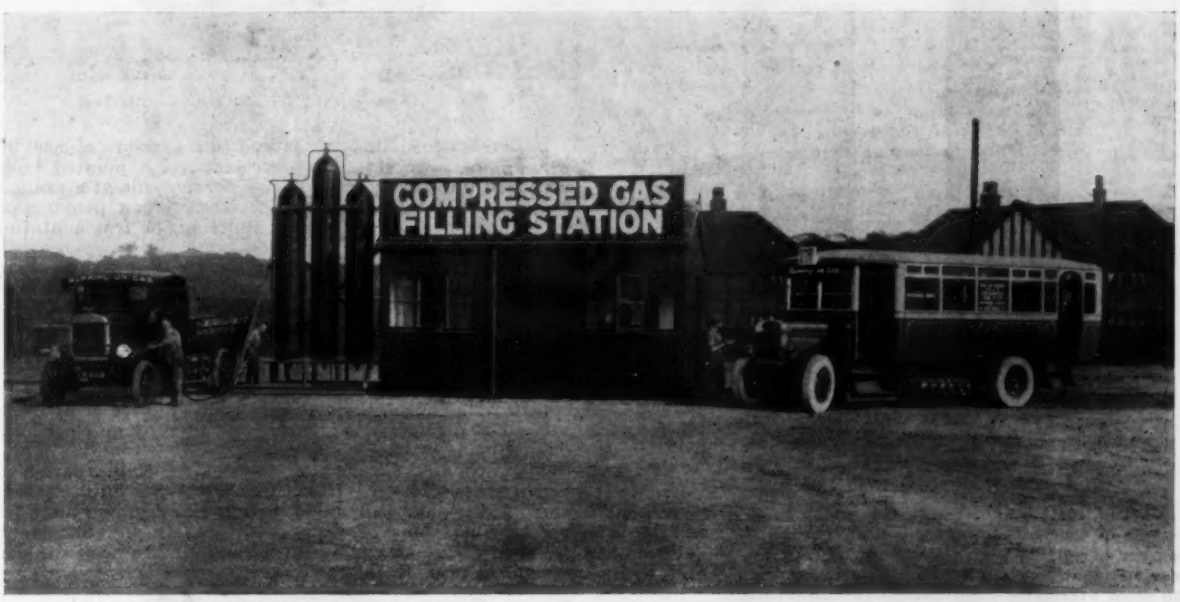
The compressing station has been erected in conjunction with the Bryan Donkin Company, Ltd., the latter being responsible for the compressor plant itself, while the Chesterfield Tube Company, Ltd., of course, supply the high-pressure cylinders—not only the smaller ones for fitting on to the vehicles, but also the large 5000-lbs. per sq. in. storage cylinders, which are an essential part of such a filling station in order to permit of rapid charging of vehicles one after another.

The use of compressed gas as a fuel for motor traction is now fully recognized as an economical proposition, and has been sanctioned by H.M. Government. Successful experiments, which have on several occasions been referred to in these columns, have been carried out by a number of gas undertakings, and rapid progress is being made in its development. The various difficulties previously encountered in the manufacture of suitable steel cylinders for storing and carrying gas under high working pressures have been definitely and successfully overcome, and "Provisional Regulations" have been issued by the Home Secretary with regard to the manufacture and use of these cylinders.

Numerous processes have been employed in the production of these high-tensile steel cylinders, but the method adhered to by the Chesterfield Tube Company, since they were established in 1906, has been the weldless solid-drawn process.

Testing the Cylinders.

To describe fully the numerous tests involved in manufacturing even the ordinary type of commercial cylinders



GAS-FILLING STATION AT THE CHESTERFIELD TUBE CO.'S WORKS, INAUGURATED LAST WEEK BY THE SECRETARY FOR MINES.

The storage cylinders are covered with insulating material.

would extend beyond the scope of this article. In the case of traction cylinders, the tests imposed are still more exacting. The Provisional Regulations stipulate certain definite requirements which have to be met under the following sixteen headings: (1) Quality of material, (2) chemical composition, (3) steel-maker's certificate, (4) manufacture

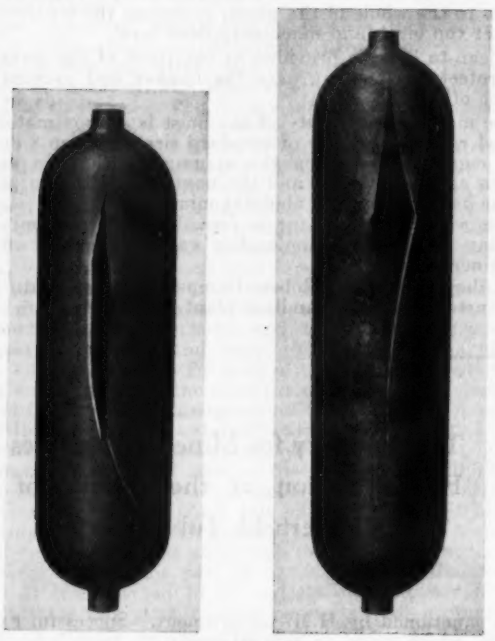


Fig. 1.—Bursting Test.

The bursting pressure of the above cylinders was 7000 lbs. per sq.in.

of cylinders, (5) thickness of cylinder walls, (6) examination of cylinder before closing-in the ends, (7) heat treatment, (8) absence of oil and grease, (9) marking, (10) tensile test, (11) impact test, (12) flattening test, (13) bend test, (14) hydraulic stretch test, (15) hydraulic test to destruction, (16) record of test.

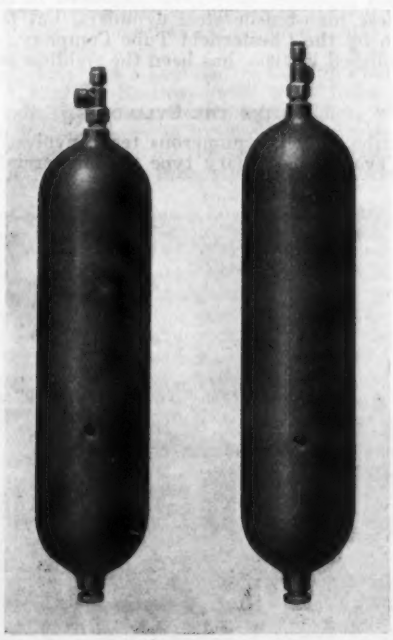


Fig. 2.—Bullet Tests, showing clean penetrations, without tearing, splitting, or fragmentation.

All the tests enumerated are included in the general routine of traction cylinder manufacture, but in addition a number of special tests have been carried out to determine exactly what can result from finished cylinders receiving the most violent and unnatural treatment.

The results established definitely that cylinders manufactured by the Chesterfield Tube Company, Ltd., are satisfactory and reliable.

Bursting Test.—Two cylinders, after the test pressure of 4500 lbs. per sq. in. had been released and adequate protection arranged, had the pressure gradually increased until bursting occurred.

The bursting pressure was 7000 lbs. per sq. in.

The nature of the bursts is shown in fig. 1 from which it will be noted that both cylinders bulged and gave no indication whatever of liability to fragmentation.

Rough-Handling Test.—Cylinders were fitted with steel plugs sweated in at one end with a standard valve at the other end and charged to a pressure of 3000 lbs. per sq. in. They were dropped vertically from a height of 30 ft. on to a concrete block. The velocity at impact would be 44 ft. per second, or 30 miles per hour.

No appreciable change was noticed in the cylinders after this test; the fittings remained intact.

A 56-lb. weight was dropped squarely from a height of 30 ft. on a cylinder placed horizontally; the result was a slight depression of $\frac{1}{16}$ in. The 56-lb. weight was then arranged to fall edge-wise on a cylinder; here again the result was merely a depression of $\frac{3}{16}$ in.

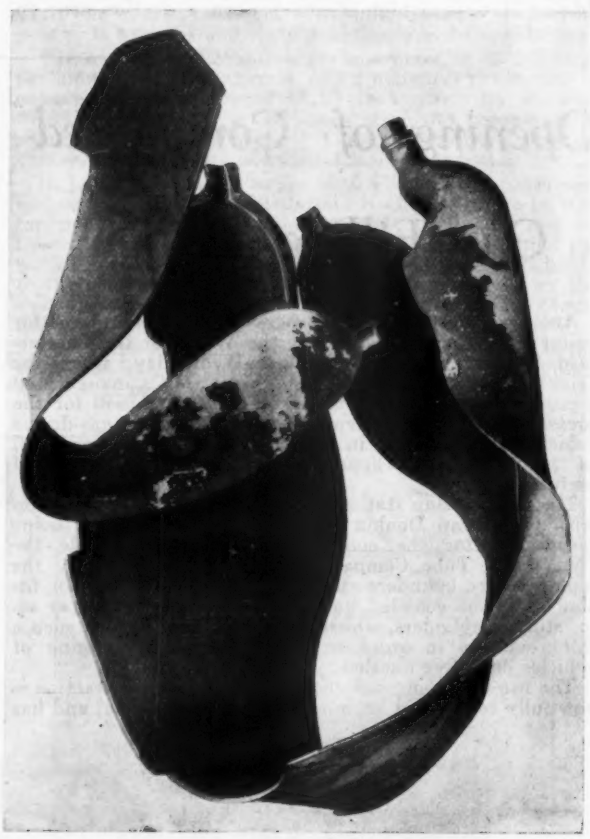


Fig. 3.—The Destroyed Cylinder after Cordite Test.

Bullet Test.—Cylinders charged to a pressure of 3000 lbs. per sq. in. were suitably protected and a pointed bullet was fired into the cylinder from a service rifle at a range of 25 yards. The results were perfectly clean penetrations without indication of tearing, splitting, or fragmentation, as shown in fig. 2.

Cordite Test.—This test was carried out at Woolwich Arsenal under Home Office directions. A trial was made to determine the nature of the fragmentation of a cylinder by means of internally applied gas pressure, the excess pressure being generated suddenly.

Gas pressure was generated by combustion of a cordite charge weighing $5\frac{3}{4}$ lbs. in the cylinder and ignition of the cordite was effected by a combustible mixture of hydrogen and air at atmospheric pressure and fired by an electrically heated bridge wire.

The estimated explosive pressure was 6000 lbs. per sq. in. The results obtained from this test were most satisfactory, the cylinder after destruction being in one piece and showing no signs of fragmentation (see fig. 3). When weighed the destroyed cylinder was found to be of the same weight as prior to the test.

Conversion of Petrol Driven Vehicles.

Official sanction by the Home Office and Ministry of Transport having been granted for these traction cylinders

to be used under the direct supervision of the Chesterfield Tube Company, Ltd., it was arranged with the close co-operation of the Bryan Donkin Company, Ltd., of Chesterfield, and the Transport and Gas Departments of the Chesterfield Corporation to convert for running on gas a four-cylinder Bristol single-decker omnibus lent by the Corporation.

(1) *Gas Cylinders.*—Six traction cylinders 7·9 in. outside diameter and 6 ft. 2 in. long, each having an approximate gas capacity of 350 c.ft. at a pressure of 3000 lbs. per sq. in., were fitted into an ash frame slung rigidly from the chassis.

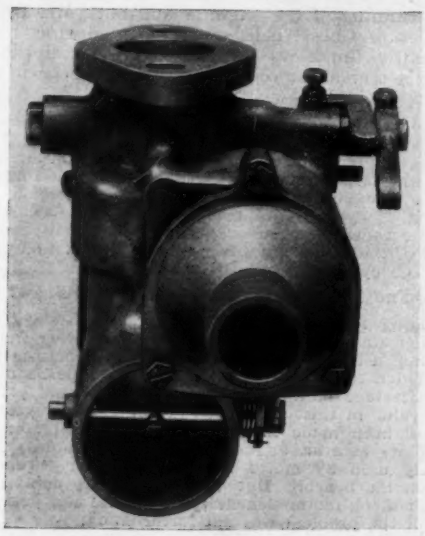


Fig. 4.—Air/gas mixers, manufactured by Messrs. Amal, Ltd., of Birmingham.

Each of the cylinders has a forged steel tee piece complete with fusible plug, the tee piece being screwed and sweated in the necked end of the cylinder, and coupled together in parallel by corrosion-resisting alloy steel tubing also manufactured by the Chesterfield Tube Company. These in turn are connected into unions having specially ground joints which form part of the forged steel tee pieces. The charging nozzle consists of a specially designed forged steel wheel valve, and is mounted on the chassis of the vehicle. This nozzle is coupled to the gas cylinder system by a corrosion-resisting steel tube and union.

A forged steel stop valve, similar in design to the charging valve, is fitted between the gas cylinder system and the governors.

(2) *Governing.*—The pressure from the gas cylinder system to the carburettor is reduced in two stages. The first governor reduces the initial pressure, ranging from 30/3000 lbs. per sq. in., down to 2 to 3 lbs. per sq. in., and the second stage governor reduces in turn to 3 in. or less water gauge vacuum. This special governor is made by the Bryan Donkin Company, Ltd.

(3) *Carburettor.*—The carburettor, or gas mixer, is connected to the outlet side of the low-pressure governor by means of 1 in. corrosion-resisting steel tubing, and is suitable for carburetting either petrol or gas. The gas portion consists of a non-return valve, a flame trap, and an orifice plate for proportioning the mixture to the engine.

There is also a slow running jet incorporated which is easily adjustable. These air/gas mixers are manufactured by Messrs. Amal, Ltd., of Birmingham, and one is illustrated in fig. 4.

Road Trials and Results.

Since October, 1932, trials have been carried out with this vehicle running on gas. An instantaneous change-over to petrol could be made at will without checking speed, so that accurate comparisons were obtainable under any conditions desired.

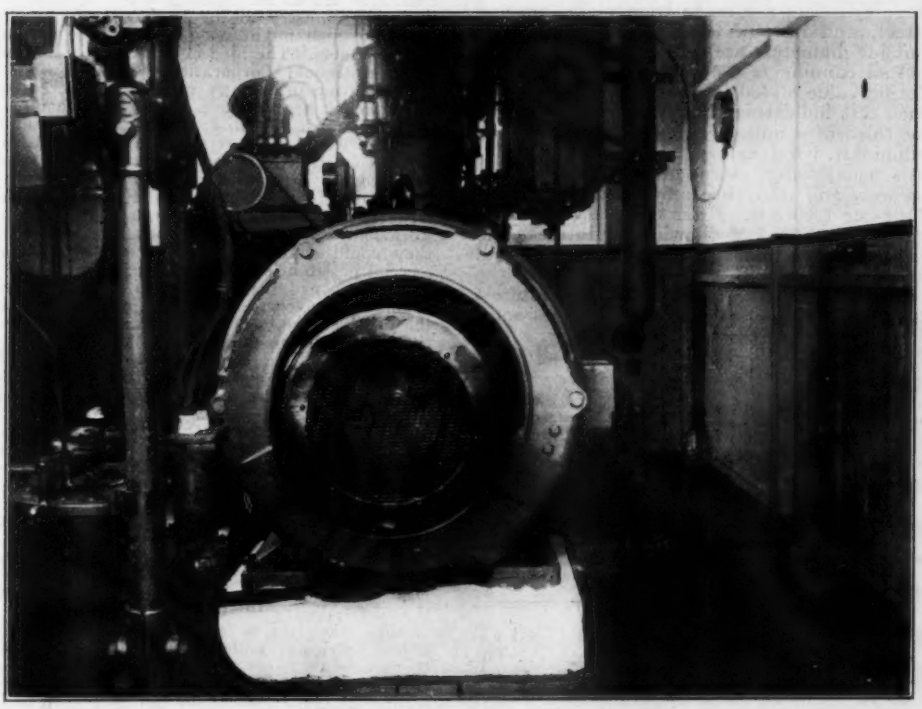
Running with a load which on petrol required 0·144 gallon per mile, the gas consumption worked out at 36 c.ft., the calorific value of the gas used being 480 B.Th.U. On this basis 250 c.ft. is equivalent to one gallon of petrol.

Other important facts of which these trials have given practical demonstration are:

(1) Decarbonization is not so necessary, as in the case of a petrol engine.
(2) The engine starts up more easily on gas than petrol, under all climatic conditions either starting from cold or when restarting while the engine is still hot.
(3) With gas, the engine can take full throttle almost instantly from cold.
(4) No difference in power output has been noticeable between petrol and gas under the average running conditions of the trials.
(5) Increased acceleration can be obtained.
(6) The engine fires more evenly at slow speeds whether idling or under load.
(7) Visible and obnoxious exhaust gases are reduced to a minimum.
(8) Re-charging with gas can be done simply and quickly.

Storage Cylinders.

For the purpose of re-fueling the vehicles, the necessity of installing charging or filling stations is at once apparent



INTERIOR OF THE GAS COMPRESSING STATION AT THE WORKS OF THE CHESTERFIELD TUBE COMPANY.

and this matter has received the attention of several of the leading manufacturers of compressing plants.

Suitable 4 and 6 stage compressors capable of raising various capacities from 600 to 6000 c.ft. of free gas per hour to a pressure of 5000 lbs. per sq. in. are already in service in different parts of the country, and the installation of many new stations is receiving the serious consideration of the authorities concerned. In this connection it is understood that the Lincoln Corporation are shortly opening a gas filling station and are converting all their motor 'buses for gas propulsion.

Storage cylinders to contain gas at extra high pressure form an essential part of the equipment of these filling stations. The normal storage pressure must, of course, be considerably higher than the maximum reached in the traction cylinders.

Other Vehicles Converted at Chesterfield.

In early February, 1933, a second Bristol single decker type of omnibus was, with the co-operation of the Bryan Donkin Company, converted for gas propulsion, and delivered to the order of the Whitwood Chemical Company, Ltd., Normanton, nr. Leeds.

The journey from Chesterfield was made in a highly satisfactory manner and much interest was occasioned when a halt took place at Rotherham Gas-Works, where the gas cylinders were recharged, 1000 c.ft. of gas being purchased.

A more recent conversion was that of the Chesterfield Tube Company's four-cylinder Dennis lorry. In this case the gas cylinders are carried on each side of the vehicle, while the arrangement of pipe lines and governors is both convenient and neat.

Three further vehicles have been converted for the Chesterfield Corporation and are running under ordinary service conditions, and obtain their fuel from the charging station just inaugurated at the Company's Works.

Compressing Plant.

The plant now in operation at the Chesterfield Tube Company's Works consists of a Bryan Donkin 4 in. stroke four-stage vertical two-crank reciprocating compressor capable of passing on an average 100 c.ft. of free gas per minute. It is interesting to note that this compressor was working at the British Industries Fair at Birmingham last February, when many of our readers probably had an opportunity of inspecting it.

The Bryan Donkin Company, Ltd., who for many years have been making gas compressors for various pressures, have given very careful attention to this subject, and have designed and constructed compressors which fulfil all the exacting conditions which have to be provided for in compressing gas to the high pressures required. The firm have published a very interesting and informative booklet on the subject of their compressors.

The compressor is driven by a 75 B.H.P. electric motor. The three storage cylinders are made from nickel chrome molybdenum steel, and have a total water capacity of 72 c.ft. The outside diameters are 21·5 in.

During an actual running test approximately 7000 c.ft. of gas of a calorific value of 480 B.Th.U. were compressed in one hour, such test indicating that it would be possible to compress one-third of a million c.ft. of gas per 48-hour week, or 17 million c.ft. per year.

Running costs comprising attendant's wages, stores, maintenance, power, and insurance amounted to 6s. 4½d. per hour, or 11d. per 1000 c.ft. of gas compressed. On a total capital outlay of £1400 and allowing for interest and depreciation on capital invested, the additional cost is 2½d. per 1000 c.ft. compressed.

Calculated on the basis of the running costs and interest and depreciation charges, the following table gives some examples of the cost of compressed gas:

Cost Price of Gas at Inlet of Compressor per 1000 C.Ft.	Total Cost per 1000 C.Ft. of Gas Compressed.	Total Cost of 250 C.Ft. of Gas Compressed—*i.e.*, Equal to 1 Gall. of Petrol.
s. d.	s. d.	s. d.
1 0	2 1½	0 6¾
1 3	2 4½	0 7½
1 6	2 7½	0 7¼
1 9	2 10½	0 8¼
2 0	3 1½	0 9¾
2 3	3 4½	0 10½
2 6	3 7½	0 10¾

This commentary shows that the application of coal gas as a fuel has already passed the experimental stage. The number of vehicles converted is increasing rapidly, and it is easy to foresee the time when the use of gas as a motive power will be quite general.

The Inauguration.

A large number of representatives of both gas and transport interests and of the Chesterfield Corporation, including the Mayor (Dr. R. A. McCrea), were the guests of the Chesterfield Tube Company at the inauguration ceremony, and were welcomed by the Chairman of the Company, Mr. W. A. Woodeson.

A number of those present had been brought from the railway station in the gas-driven omnibus. After the Secretary for Mines had set the compressor in motion, demonstrations were given of the rapid manner in which various vehicles could be charged and of the efficient lay-out and running of the engines, and both Mr. Brown and the Mayor of Chesterfield went for trial runs in lorries. Subsequently lunch was served in the Chesterfield Tube Company's recreation room, Mr. Woodeson occupying the chair.

Mr. Woodeson, proposing the toast of "The Secretary for Mines," referred to the honour that Mr. Brown had done them in coming to inaugurate their new filling station. He also spoke of the large amount of research and experimental work which the Company had carried out in connection with the production of cylinders to comply with Home Office Regulations. In conclusion, he asked Mr. Brown to accept as a memento of the occasion a silver replica of the three high-pressure storage cylinders.

From Experimental to Commercial Stage.

Responding to the toast, Mr. Ernest Brown said that the event which was taking place that day might very well prove—and one hoped that it would prove—to be an epoch-making one. It represented the passing from the purely experimental to the commercial stage of a development which should prove to be of great value in this country. For nearly forty years experiments had been made in the use of gas for motor traction. Its suitability as a motor fuel had long been known, and it was extensively used by motor manufacturers for "running in" engines on the bench. But gas was a bulky substance to be carried about on motor vehicles, and until a few years ago the solution of the problem was not forthcoming.

In 1919 the Government set up an influential Departmental Committee to consider the use of gas for motor transport. This Committee foresaw a considerable future for gas in this direction, but it recognized that a means of storing the gas under considerable pressure must be found, and for this purpose strong, but light, steel cylinders were suggested. The Committee expressed the opinion that gas traction was fully as safe as any other system of mechanical traction. Since the Committee reported, much work had been done by the Chesterfield Tube Company and others in evolving light high-pressure steel containers which would make the use of gas a practicable proposition; and work of this kind deserved the highest praise. The Committee stressed the desirability of using compressed gas on account of the "national importance of ordinary town gas as a home-produced fuel."

In these days they were realizing more than ever before the importance of promoting and expanding home industries. That was why the developments which were taking place in connection with the use of compressed gas for motor transport and such schemes as the hydrogenation of coal were so important. The coal industry to-day had need of help from any new invention which might open the door to new uses for coal and coal products. The idea of the Chesterfield Tube Company and the Chesterfield Corporation of establishing the first public filling station in a centre where there were good supplies of gas available at a reasonable rate was a good one, continued Mr. Brown; and it was to be hoped that all the colliery and allied interests would support the move by converting their vehicles, or a proportion of them, to use gas, and thus provide the experience which would doubtless enable further improvements in the system to be effected, and its use extended. Some of the large gas undertakings who were actively associated with the work had considerable fleets of motor vehicles themselves which they could convert, and thus help to demonstrate the commercial possibilities of compressed gas.

It was hoped that definite arrangements would be made to enable coke ovens having supplies of gas available to share in the new venture, and that as more low-temperature carbonization plants became established the gas of high calorific value which some of these provided would also be brought into service. The two firms which had done the bulk of the work on the steel containers were the Chesterfield Tube Company and Vickers-Armstrongs; and the gas authorities which had taken a leading part were the Birmingham Gas Department, the Gas Light and Coke Company, the Chesterfield Gas Department, the Tottenham and District Gas Company, and the Rotherham Gas Department.

Alderman G. Clark, J.P., proposing the toast of "Our Guests," referred to the fact that the gas used was produced at the Grassmoor coke ovens, so that they had already done something towards linking up the coke oven industry in the great venture that day. The use of these vehicles, however, was circumscribed to a certain extent—that was to say, until the Gas Industry throughout the country put down such filling stations the vehicles could only be operated in the areas of a few particular undertakings. And when he told them that there were no fewer than 1849 gas undertakings in this country they would realize that there was room for considerable development. Having referred to the high esteem in which the Gas Industry was held by the investing public, Alderman Clark con-

cluded by saying that the project they had started that day was going to be of great assistance to the Gas Industry as a whole.

Mr. J. A. AITON, C.B.E., J.P., responding to the toast, remarked that while there were manufacturing firms like the Chesterfield Tube Company who were prepared to take risks and carry out experiments and bring them to a successful conclusion they need not have any fear for the future of this country. He thanked the firm for entertaining them on that occasion.

The MAYOR OF CHESTERFIELD (Dr. R. A. McCrea), in proposing the toast of "The Chesterfield Tube Company," said he had known the firm since it was ten years old, while he had been fortunate in knowing the heads personally. The Company were manufacturing various products which, from the doctor's point of view, were essential—such as oxygen cylinders and anæsthetic containers. The Chesterfield Corporation had done—and intended to do—all they could to advance this scheme. They knew perfectly well that the prosperity of this country depended to a large extent on coal.

Southern Association of Gas Engineers and Managers

GENERAL MEETING IN LONDON

A General Meeting of the Association was held at the Hotel Metropole, London, on Wednesday, Nov. 15—the PRESIDENT (Mr. J. H. Cornish, of Bridgwater) in the chair.

The Minutes of the preceding meeting (as published in the "GAS JOURNAL") were taken as read and were confirmed and signed.

ELECTION OF PRESIDENT FOR 1934.

The PRESIDENT proposed the election of Mr. Stephen Lacey (Controller of Gas Sales, Gas Light and Coke Company) as President for 1934. Mr. Lacey, he said, had served as Vice-President, and he was connected with the largest and most important gas undertaking in the world, which was always willing to help any undertaking which needed its assistance. Mr. Lacey personally, too, was always willing to do his best for any company or any member who needed his assistance.

Mr. T. CARMICHAEL (Portsmouth) seconded, and commented upon Mr. Lacey's enthusiastic work and his interest in the whole range of gas activities. As a colleague on the Council of the Institution of Gas Engineers and a fellow member of the co-ordinating Committee dealing with domestic and industrial gas, he knew the value of Mr. Lacey's work, and was satisfied that he would be a most enthusiastic President.

Mr. LACEY expressed his thanks for the heartiness of the reception accorded the proposal, and assured the meeting that he would do his best, with the help of the Council and the Hon. Secretary, to carry on the work which had been done by the Association for so many years. He also commented upon the fact that, with very few exceptions, if any, the Presidents of the Association had been engineers, and it was perhaps a sign of the times that on this occasion the Association should have elected one who, although he had had engineering experience and trainng, was practising as a sales manager. He conceived it to be his special duty during his year of office, therefore, to focus attention on the problems of utilization and sales, and he hoped that that would meet with the approval of the members.

ELECTION OF VICE-PRESIDENT.

Mr. LACEY proposed the election of Mr. E. L. Nicholas (Engineer, Manager, and Secretary, Guildford Gas Company) as Vice-President for 1934.

Mr. R. H. RUTHVEN (Ramsgate) seconded, and Mr. NICHOLAS briefly responded.

OFFICE BEARERS FOR 1932.

President.—Mr. Stephen Lacey, Gas Light and Coke Company.
Vice-President.—Mr. E. L. Nicholas, Guildford.
Hon. Auditors.—Messrs. James Donaldson and John Urquhart.

MEMBERS OF GENERAL COMMITTEES.

The HON. SECRETARY (Mr. J. H. Donaldson) indicated the names of the members of the Eastern and Western District Committees as follows:

EASTERN DISTRICT.

Chairman.—Mr. E. F. Smallbone.
Vice-Chairman.—Mr. S. E. Whitehead.
Committee.—Messrs. C. V. Bennett, W. H. Bennett, C. F. Botley, G. R. Bullwinkle, T. Carmichael, J. H. Cornish, J. H. Donaldson, H. Gage, W. Grogono, J. F. Haseldine, W. A. Howie, L. G. Humphrys, D. F. Irving, S. Lacey, L. J. Langford, E. L. Nicholas, C. T. Price, F. J. Robinson, R. H. Ruthven, C. H. Rutter, W. J. Sandeman, H. C. Smith, A. W. Sumner, and L. Trewby.
Hon. Secretary.—Mr. W. A. Howie.
Representatives on the General Committee.—Messrs. W. H. Warren, J. Terrace, D. C. Cross.
Representatives on District Education Committee of the I.G.E.—Messrs. D. C. Cross, H. Gage, W. Grogono, and S. E. Whitehead.

WESTERN DISTRICT.

Chairman.—Mr. F. Blackburn.
Vice-Chairman.—Mr. J. B. Cattle.
Committee.—Messrs. J. Armstrong, R. J. H. Clark, J. H. Cornish, C. G. Dawson, W. E. Dean, J. H. Donaldson, S. E. Halliwell, C. Harris, H. Higham, P. S. Hoyte, S. J. Ingram, S. Lacey, J. H. Lowther, E. L. Nicholas, J. H. Pye, E. Samuel, C. Stapleton, J. Taylor, A. Thomas, H. W. Versey, and W. N. Westlake.
Hon. Secretary.—Mr. J. H. Cornish, Jr.
Representative on the General Committee.—Mr. A. Thomas.
Representatives on District Education Committee of the I.G.E.—Messrs. F. Blackburn, C. Harris, R. Robertson, and W. N. Westlake.

NEW MEMBERS.

The following new members were elected: Messrs. F. T. Buist, South Suburban Gas Company; E. L. Oughton, South Suburban Gas Company; W. J. R. Waterfield, Gas Light and Coke Company; T. N. Ritson, Chichester; F. C. Briggs, Dudley; S. E. Knowles, Eastbourne; W. Miller, Walton; W. E. Plevin, Romford; C. W. M. Rogers, Gas Light and Coke Company; and D. G. Snow, Walton-on-Thames.

PRESENTATION OF CERTIFICATES.

Certificates, which were awarded to the following, were presented by the President:

EXTERNAL HIGHER GRADE GAS ENGINEERING.

F. W. Sanson	Exeter
F. A. Butt	Paignton
T. B. Wilkinson	Stroud

EXTERNAL HIGHER GRADE GAS SUPPLY.

F. W. Sanson	Exeter
A. E. Haffner	London
B. G. H. J. Hawkings	Plymouth
H. Moys	London
I. D. Nachman	Tunbridge Wells
I. M. Wilson	Croydon
D. J. Bath	Teddington

INTERNAL HIGHER GRADE GAS SUPPLY.

F. E. W. Baker	London, East Ham
G. W. Conner	Barking
S. Gallington	Manor Park
W. Shapland	Ilford
A. Sullivan	Forest Gate
H. J. Chubb	London
C. D. Dolton	Chelsea
A. G. Driver	Sydenham
J. H. Gibbons	Wallington
S. W. Hayes	New Malden
A. F. Hedges	Watford
W. E. Huffer	Battersea
E. L. Kennedy-Wilson	London
N. R. Junkinson	Purley
W. J. Kibble	Croydon
C. W. Raworth	Leyton
L. J. Smart	Tufnell Park
H. A. Tulley	London
F. J. Walter	London
M. J. White	Stoke Newington
A. S. Williams	London
A. G. Willmott	London

PRESENTATION OF PAPERS.

The following papers were then presented by their authors: "Considerations of a Coal Handling Problem," by Mr. R. J. H. Clark (Plymouth), and "Coal Carbonization by Internal Heat," by Mr. S. Moore (Burnham-on-Sea). These papers and a report of the discussion will be found on later pages.

Considerations of a Coal-Handling Problem

By Mr. R. J. H. Clark, M.Inst.Gas E., Engineer to the Plymouth and Stonehouse Gas Light and Coke Company.

[Papers read before the Southern Association of Gas Engineers and Managers, Nov. 15, 1933.]

Having been honoured with an invitation to provide a short paper, I chose this subject in the hope that the information given would prove at least of passing interest to all, and possibly of some practical use to such members as may find occasion to consider different methods of coal handling.

In our case, this need arose about three years ago, and the following is an outline of the three major schemes that were considered, but which, unfortunately, had to be abandoned owing to their capital cost being too high for the tonnage handled. In conclusion, details are given of the improvements finally adopted.

My Company carbonize some 80,000 tons of coal per annum, and this is all water-borne, either from the Tyne or the Humber, to a wharf in Sutton Harbour, Plymouth, just opposite the Barbican whence the Pilgrim Fathers sailed to America in " The Mayflower " in 1620.

The quay at which our boats are discharged is the property of a local Harbour Company and consists of a water frontage 815 ft. in length, at which cargoes other than our own coal are handled. The berth allotted for the Gas Company's colliers is about 268 ft. long, and until about fourteen years ago the installation used for discharging the boats was the property of the Quay Owners, by whom our boats were unloaded. In 1919 we acquired this equipment, consisting of two 5-ton (free on rail) locomotive cranes and two wheeled hoppers of 25 tons capacity fitted with wagon loading chutes into which the cranes discharged.

Having regard to the fact that the berth is a tidal one, and that the colliers vary both as regards the number and relative positions of their holds, it will be noted that the existing equipment for discharging left little to be desired, and that any improvements to be effected in this connection lay in the direction of tuning up, and, where possible, modernizing that equipment, rather than in the acquisition of a new and different type of plant.

The cranes were in good order and capable of many years further service, but, judged by modern standards, their performance was prejudiced by the fact that the single-chain grabs were unduly high, a circumstance which left very little length of chain between jib head and hood of grab when the latter had been hoisted sufficiently to allow it to swing over the adjacent 18 ft. hoppers. Frequent breakages in the chain took place, always at that point, due to the strain of the swinging grab being taken on a very few links.

The grabs themselves were heavy in relation to their capacity, and it was obvious that a modern type of grab would enable us to handle a much larger amount of coal per lift, without adding to the gross load on the jib head, always providing that the cranes themselves could be altered to wire rope working in place of the existing chains.

Some time naturally elapsed, before, with the equipment in our hands, we became thoroughly familiar with the characteristics and limitations of this installation; but it was eventually decided that it was better to modernize than purchase new, and the manner in which the work was carried out will be described in a subsequent part of this paper.

The distance between the quayside hoppers and the coal store on the Works is about 635 yards, of which about 120 yards of route lie over a public road. It will be noted that although the Works entrance is very near to the point of discharge, the nature of the intervening land is such as to rule out the possibility of using any purely mechanical method of transportation, and also, that vehicles used for this purpose must necessarily be licensed under the Road Act, because of the public thoroughfare over which they have to pass.

For many years, coal has been brought into the Works by our fleet of six-ton Yorkshire steam wagons which, when not engaged for this service, are used to a considerable extent for other purposes.

These wagons are end tippers, each weighing about eight tons, fitted with bodies 12 ft. 9 in. by 7 ft. 3 in. by 3 ft. 6 in. inside measurements, and capable of carrying an average load of 6¼ tons of coal. This method has been found a very economical one, although the heavier new taxation which we shall shortly have to face has compelled us to examine other means of transportation.

Greater Storage Capacity.

The utilization of one of our Works coal stores for other purposes rendered it necessary for my Company to acquire a site which should offer far greater storage capacity than we had hitherto enjoyed, and in 1926 a site of approximately rectangular shape, with an area of 54,000 sq. ft., was acquired adjacent to the discharging berth.

A substantial ferro-concrete wall was erected on the quay side of this site, the other three sides being formed by the quarry, out of which, at some earlier date, the site had been worked.

It was desired to take immediate advantage of the storage facilities offered by this site, and, as a temporary measure, an arrangement was made with the Company owning the quay, whereby a small 3-ton grabbing crane should be at our disposal when required. A turntable was fitted on the quayside tracks, and a temporary track laid on the concreted surface of the site. The latter was moved from time to time according to the position of the silos required, the coal being brought into and tipped on the site by our steam wagons, and stacked by the hired crane. Besides being costly, due to the hire rate, this crane could only handle some 20 tons of coal per hour or a total of about 20,000 tons per annum into our site during the discharging periods. Calculated on this maximum quantity the cost of stacking and re-claiming into wagons would be about 9½d. per ton.

The problem of installing a permanent equipment for storing into, and subsequently reclaiming from, this site was somewhat involved, as although we wished to make the best economic use of it under existing conditions, it was necessary to anticipate certain eventualities in connection with our Works which might possibly require us to consider this storage in the light of a main, rather than a reserve, source of supply.

The three following major schemes were accordingly considered and their respective performances compared on the assumption that 50,000 tons per year would be handled over the site—the balance being brought direct from quay to Works store. This basis of comparison, it will be noted, operated to minimize the unfavourable incidence of the capital charge, but was greatly in excess of present requirements.

Reference has already been made to the fact that the berth was a tidal one, and to the variations in the type of boats to be handled. These conditions deprived us of fixed points of discharge from which to work, so that each scheme had to be sufficiently flexible to allow of its collecting coal from our quayside hoppers at any position which the latter might occupy on the hopper track.

Another circumstance which had a considerable bearing upon the cost and designs of the schemes prepared lay in the need for our observing the rights of other users of the quay—namely, the Great Western Railway Company, and traffic running over the quay to a large coal merchant's plant situated beyond our cranes. For this reason, it was necessary to keep such units of the new schemes as lay outside our own property, either underground or at a considerable height above ground.

Scheme " A "—Telpher.

This scheme is shown in outline in fig. 1, and comprised a radial stacking bridge commanding a large area of the site and associated with a fixed telpher track running out of the store and turning parallel with the quay. The trestle legs carrying the quayside section of the track were sited inside the coal store wall, and were of cantilever construction, so as to observe the conditions imposed by the owners of the quay.

Each existing hopper was to be furnished with a skip filler capable of longitudinal movement in company with the hopper, and provision was made for working the ordinary wagon loading chutes and the skip filler simultaneously. The skips, each of 3½ tons capacity, were to be handled by two top rail telphers and carried back to the radial bridge *via* an automatic weighing machine sited near the entrance to the bridge, where both ingoing and reclaimed coal could be weighed with equal ease and speed.

The stacking bridge had an angular range of about 120°, and telphers were free to enter and leave it at all positions.

With both telphers working, this plant had a capacity of 120 tons per hour, the coal being dropped in radial heaps and the bridge shifted from time to time as these accumulated.

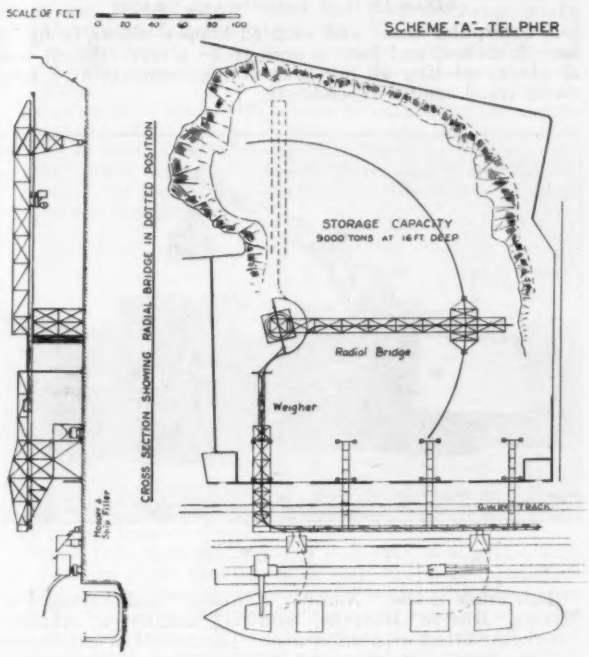


Fig. 1.

Reclaiming was to be carried out by one machine working with a grab in place of the skip and carrying its load from the bridge over the weighing machine to an overhead wagon loading hopper, sited just inside the coal store wall.

From a purely engineering point of view, this proposal left little to be desired, as, with the exception of having to substitute a grab for a skip, the same plant was used for both bringing in and reclaiming coal.

Scheme "A"—Telpher.

	£
Capital cost	9,986
Our work	1,000
Total cost	£10,986

Cost of Storing and Reclaiming 50,000 Tons per Annum.

	£
Capital and depreciation at 10%	1098
Maintenance and insurance	212
Power	100
Supervision	100
Labour—storing at 120 tons per hour	57
Labour—reclaiming at 60 tons per hour	107
	£1674
Cost per ton (capital)	5·27d.
,, ,, (total)	8·02d.

Scheme "B"—Drag Line.

This proposal is outlined in fig. 2, and comprised a series of conveyors carrying coal from the quayside hoppers into the walled store, the final distribution and reclaiming being effected by a drag line scraper. An underground conveying belt ran parallel to the quay, immediately under the hopper track, suitable traps being provided to permit of the fall of coal on to this belt at all positions of the movable hoppers.

A cross conveyor carried the coal into the store, whence an inclined belt running over an automatic weigher discharged the coal into two dumps. A drag line, the capacity of which varied from 120 tons per hour at 120 ft. radius to 100 tons per hour at 180 ft. radius, operated between these dumps and a number of radial anchorages on the boundary of the site. Adjacent to the dumps were two overhead hoppers fed by vertical elevators for the purpose of loading wagons with reclaimed coal.

As drag line scrapers are rather uncommon, a brief description may not be out of place. They consist essentially of four elements, a scraper bucket, a set of cables with sheaves and fittings, a double drum winding engine, and a number of fixed points for cable attachment.

The bucket has cable attachments at its front and rear, and ropes run from both, through sheaves to the drums of the winding engine. For distribution to storage, the bucket is placed behind an initial pile of coal formed near a head post, with its open end towards the storage area and the front rope leading through a sheave on one of the fixed points at the far edge of the site, back to the engine *via* the fixed head post. The back rope leads directly to the engine *via* the same head post. The front rope is then wound in on the engine and the back rope paid out at the same rate, so that the bucket filling itself from the initial pile drags its load out to any desired distance.

When the engine is reversed, the bucket is automatically emptied and returns to its original position for a further load. The direction of the bucket can be changed by altering the location of the out-haul sheave.

For re-claiming, the operation is the same, but with the bucket reversed and dragging coal back to the boots of the wagon-loading elevators.

Scheme "B"—Drag Line.

	£
Capital cost	5800
Our work	700
Total cost	£6500

Cost of Storing and Reclaiming 50,000 Tons per Annum.

	£
Capital and depreciation	650
Maintenance	133
Power	480
Supervision	100
Labour—storing at 100 tons per hour	34
Labour—reclaiming at 60 tons per hour	107
	£1504
Cost per ton (capital)	3·12d.
,, ,, (total)	7·21d.

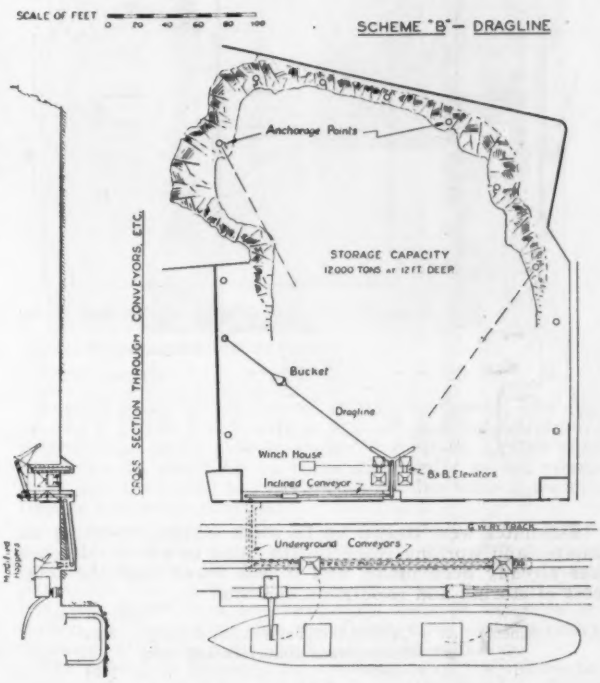


Fig. 2.

Scheme "C"—Tripper Conveyor.

This scheme, outlined in fig. 3, provided for the carrying in of the coal to be stored by a system of underground conveyors, two of which were parallel to the quayside and lay under the track on which the existing hoppers ran.

Working together towards a common point, these belts discharged their loads on an underground cross conveyor, which carried the coal just inside the storage site. From this point, a tripper line conveyor ran at right angles to the wharf to the extreme end of the site, passing *en route* over the tripper, a structural steel carriage straddling the conveyor, mounted on flanged wheels and arranged to run on a rail track. At the delivery end of this belt an automatic belt weigher was provided. The forward end of the tripper carriage carried an inclined conveyor mounted on a

roller path and capable of rotating through an angle of 180° at a radius of 47 ft.

From fig. 3 it will be noted that by moving the carriage forward and adjusting the radial inclined conveyor, storage heaps could be formed on each side of the central track, each heap having a capacity of about 4000 tons. Reclaiming was arranged for by a petrol-driven grabbing crane, with a capacity of 40 tons per hour, mounted on caterpillar tracks, and discharging into a wagon-loading hopper.

Scheme "C"—Tripper Conveyor and Petrol Crane.

	£
Capital cost	6005
Our work	700
Total cost	£6705

Cost of Storing and Reclaiming 50,000 Tons per Annum.

	£
Capital and depreciation	670
Maintenance and insurance	184
Power (electricity and petrol)	158
Supervision	100
Labour—storing at 100 tons per hour	30
Labour—reclaiming at 40 tons per hour	162
	£1304
Cost per ton (capital)	3·21d.
,, ,, (total)	6·26d.

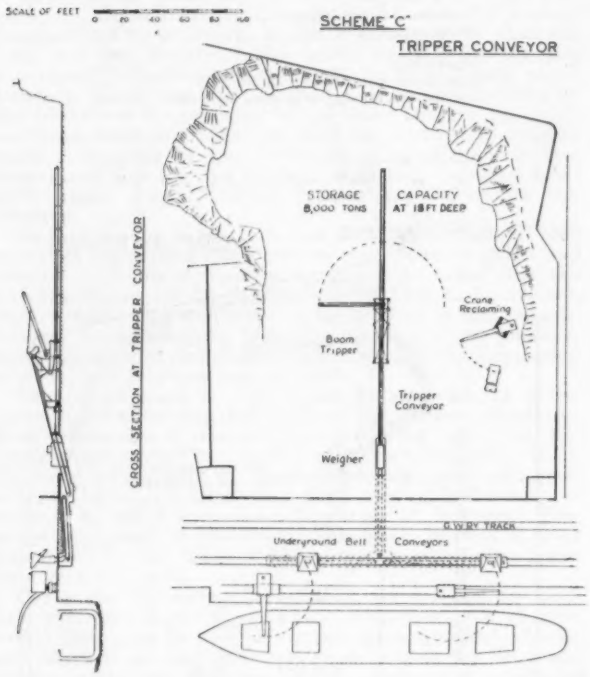


Fig. 3.

Estimates were drawn up for each scheme, covering all capital and working costs, on the basis to which reference has already been made, and it was found that the total cost of storing and reclaiming coal was:

	Pence per Ton.
Scheme "A."—Overhead telpher with radial bridge	8·02
,, "B."—Underground conveyors and drag line	7·21
,, "C."—Underground conveyors, tripper conveyor, and caterpillar crane	6·26

These figures represented the cost of handling coal from the point of discharge at the quayside hoppers, stacking into the store, and ultimately reclaiming into wagons for transit to the Works.

It was obvious that the storage of coal direct into site at a high rate of working, and the leisurely reclamation to suit the needs of the Works, would allow certain economies being effected—namely,

(*a*) A saving in freightage charges due to the quicker despatch of the colliers.

(*b*) A reduction in the number of steam wagons used in transporting coal to the Works.

These sources of saving were carefully examined, but it was found that the combined economies to be so effected were insufficient to warrant the laying down of plant on the lines suggested. It was accordingly decided to install a purely portable type of plant for stacking wagon-delivered coal, and reclaiming it into wagons, leaving the site itself clear for the erection of a handling installation, as and when the development of our Undertaking suggested the economic need for a further alteration.

Steam-Driven Caterpillar Crane.

A caterpillar crane and wheeled hopper, shown in fig. 4, were installed, and have proved to be a very efficient unit of plant, meeting all our present requirements at a relatively small capital expenditure.

Fig. 4.

This crane is the "Number 6 Junior," manufactured by Messrs. Ruston Bucyrus, and is actually a standard excavator fitted with an ordinary jib instead of excavating tackle, and is so arranged as to permit of inexpensive conversion to an excavator should such a need ever arise. It is fitted with a 24 c.ft. two-rope Priestman grab, and handling its load at a radius of 32 ft. gives a dumping height of 21 ft.

A consideration which led us to view this solution with considerable favour lay in the fact that a breakdown of one of the quayside cranes would naturally involve us in substantial demurrage charges in respect to delay in the unloading of colliers.

By fitting the Ruston Bucyrus crane with a curved jib, it will be noted that our purchase fulfilled a dual purpose, in that it enabled us to stack and reclaim coal on the site, and at the same time gave us a third crane to supplement the existing quayside equipment. Under normal conditions, with one man, it is easily capable of handling 60 tons per hour, but the employment of a second man for firing would permit of its being worked at double this rate. Although the grab capacity of the crane is somewhat small, its general design together with its separate engines for slewing and travelling, and the easy nature of the controls provided, are such as to give it an exceptional turn of speed when rapid working is rendered necessary.

Our method of working is still the same as when we were using the hired crane, but with much greater speed and reduced expense, as is shown in the following table of costs.

It is interesting to note that with these figures equated to a basis of 20,000 tons per annum, the cost per ton would be 6d. as compared with the previous figure of 9½d.

Ruston Crane.

	50,000 Tons per Annum. £
Capital cost	2190
Hopper	175.
Total	£2365

Cost of Storing and Reclaiming.

	£
Capital and depreciation	236
Maintenance and insurance	75
Fuel and oil	63
Supervision	100
Labour—storing at 60 tons per hour	107
Labour—reclaiming at 60 tons per hour	107
	£688
Cost per ton (capital)	1·13d.
,, ,, (total)	3·3d.

While the above figures are comparable with the performance of the hired crane, for comparison with Schemes "A," "B," and "C" the sum of 2·05d. per ton should be added, representing the cost of transporting coal from the quayside hoppers to store.

Alterations to Cranes.

Our next step was to consider what could be done to improve the performance of our quayside cranes, with a

view to facilitating the despatch of the boats and minimizing the somewhat heavy maintenance charges and the petty annoyances (generally causing delay), which are often inseparable from the use of old machinery.

The cranes themselves were now in thoroughly good order, but the dash pot controlled ring discharge grabs were a source of frequent trouble. These grabs were of very small capacity in relation to their gross weight, and their height was largely responsible for the trouble with the chains.

Inquiries were made with a view to examining the merits of a totally different type of grab, and the following table will be of interest as showing the difference between our original grabs and those finally purchased from Messrs. Priestman, in regard to both capacity/dead weight ratio and overall dimensions.

—	Original Grabs.	New Priestman Grabs.
Heaped capacity, c.ft.	72	93
,, ,, cwt.	30	39
Weight, cwt.	50	40¾
	Ft. In.	Ft. In.
Width	6 0	6 0
Spread of jaws, open	8 5	8 9
Height, open	11 7	9 9
,, closed	10 10	7 9

It is interesting to note that the use of these new grabs would reduce the useless weight of metal lifted by practically 50,000 tons each year.

It was felt, however, that to associate new grabs with the existing chain tackle would scarcely be an attractive proposition, inasmuch as we should still suffer from that sense of uneasiness inspired by a long experience of chains and their vagaries. The type of crane ruled out all possibility of using a double-rope grab, and our choice in this connection was accordingly limited to a single-chain or wire rope ring discharge grab.

Inquiries into the question of an all-rope-operated grab were not encouraging, and it was decided to install chain-operated grabs and to convert the cranes themselves to wire rope operation, the connection between the grab chains and the wire ropes being made *via* Bordeaux connections and a ball-bearing swivel.

In view of the fact that this junction would have to pass over the jib head pulleys twice per lift, the cranes were fitted with 36 in. diameter cast steel jib head pulleys grooved to take the largest portion of the junction between chain and rope—namely, the ball-bearing swivel. The crane which was the worst offender in the matter of clearance between hoisted grab and jib head pulley (and in spite of the advantage in decreased grab height, it was still felt desirable to eliminate this circumstance) was fitted with substantial side cheeks at the jib head between which the new sheave was fitted, giving a very acceptable increase of about 2 ft. in height at this point. This alteration is shown in fig. 5.

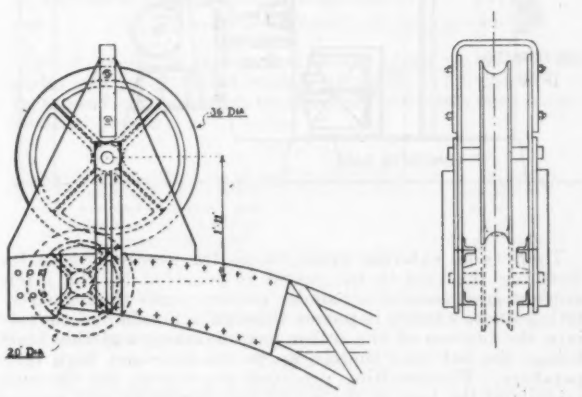


Fig. 5.

The hoisting drums, grooved for $\frac{15}{16}$ in. links had to be machined out and generally eased to ensure the sweet running of a 3½ in. wire rope in the same grooves. In the case of one crane, the drum was removed bodily and machined in a lathe. The second crane, however, presented a much more difficult problem, inasmuch as its construction did not permit of the ready removal of the drum in the limited time at our disposal. A slide rest was accordingly rigged in front of the drum, a projecting tongue engaged with the existing groove, and, using the drum as a leading screw, the curves were increased in diameter and machined to the shape required.

An interesting feature of the job lay in the fact that the time available for making the complete alteration was about ten days, in which we had not only to work to a carefully prepared programme, but to negotiate the unexpected difficulties which arose as soon as the job was under way.

From the point of view of performance and suitability to the cranes, the new equipment was a complete success, but we encountered one unexpected difficulty, worthy, perhaps, of somewhat detailed description. The junction between wire rope and Bordeaux connection, previously referred to, was made by a very long splice. This splice gave trouble from the beginning, becoming distorted and ragged, and speedily assuming an appearance which raised great doubt as to its continued safety. Representations were made to the makers and spare ropes ordered, but the trouble persisted and we were compelled to seek our own remedy.

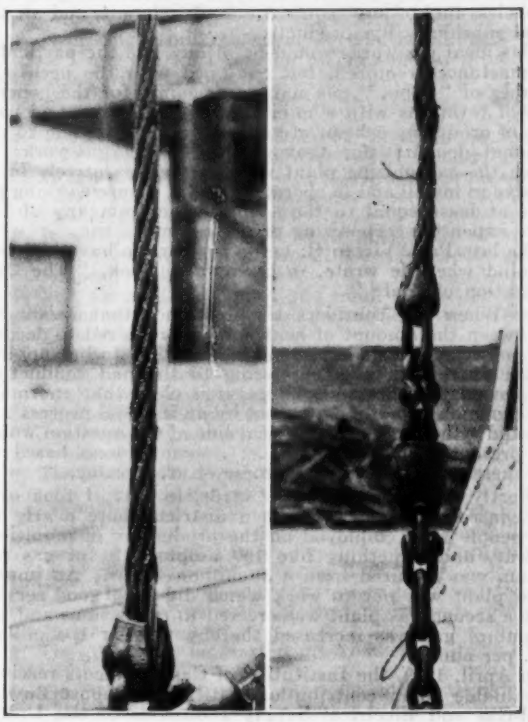


Fig. 6.

Locally made splices proved equally inefficient, but ultimately I got in touch with a firm of rope manufacturers who claimed to be able to supply a specially spliced rope which would stand up to these admittedly severe conditions, and I am glad to say that since using their ropes this trouble has never recurred.

Our experience with the first ropes was such as to suggest the need for re-splicing the outer end after hoisting between two and three thousand tons (net). With ropes purchased from this new source, we have handled never less than 40,000 tons, and even then the rope has been returned to the makers for re-splicing as a precautionary measure rather than for any appreciable weakness.

The difference between the appearance of the splices towards the end of their useful life is clearly shown in fig. 6. The distorted splice has carried less than 4000 tons and is in a thoroughly dangerous condition, while the uniform tapered splice has done ten times that duty and is still fit for further service.

Our method of working is to buy a rope with both ends spliced for jib head passage and furnished with a Bordeaux connection. When the outer end shows signs of wear the rope is changed end for end, as a splice which would be weak under the severe conditions of jib head passage is perfectly safe when anchored back on the hoisting drum. When the outer end of the reversed rope shows signs of wear, the rope is returned to the makers and each end re-spliced for a final period of service.

Such then was the manner in which, largely by a system of elimination, we dealt with our problem. If the results are not spectacular, they are, I believe, at least economically sound, which, after all, is the acid test of engineering policy.

The major schemes examined were full of interest, and

reflected much ingenuity and resource upon their sponsors, and had the quantity of coal to be handled been greater, the employment of one of them might have proved amply justified. That such schemes had ultimately to be abandoned in no way detracted from the interest which their examination afforded me, and which I venture to hope I may, in some small measure, have imparted to you. If such should be the case, my natural gratification will, I feel sure, be shared by those members of my staff who have co-operated with me in the preparation of these notes and their accompanying illustrations, and to whom I gladly tender my sincere thanks and appreciation.

Coal Carbonization by Internal Heat

By Samuel Moore, M.Inst.Gas E., Burnham-on-Sea, Somerset.

For many years gas engineers have visualized the possibility of operating a gas-works in which all the gas would be produced by a single-stage process in internally-heated, mechanically-operated machines; each unit producing from suitable coal any desired quality of combustible gas, *plus* smokeless fuel of any required volatile content, and all the usual subsidiary bye-products.

This ideal gas-works would be of any size the particular circumstances required, but equipped with the necessary number of "robot" gas-making machines for the generation of town gas with a minimum of fuel losses, and capable of producing coke or of gasifying coke according to the seasonal demands for that commodity; a gas-works in which the carbonizing plant would be comparatively inexpensive to install and to operate, and yet ensure working results at least equal to those obtainable from any of the more expensive carbonizing processes now in use.

The late Prof. Vivian B. Lewes appears to have had this in mind when he wrote, in his notable book, "The Carbonization of Coal:"

> When one considers the difference that exists between the amount of heat actually required to decompose the coal and the amount that has to be supplied in an ordinary setting owing to the bad conducting power of retort and charge, it is clear that enormous economies could be attained by an internal process . . . and although the mechanical side of the question would present great difficulties . . . some process based on these principles might become of great value.

Shortly after reading these words, in 1917, I took over the control of a gas-works in a district where nearly all the people were employed on the production of munitions of war, and something like 100 million c.ft. of gas per annum was required from a 50-million works. An improvised plant was put to work which did such good service that a second gas plant was erected to my designs and the output of gas was increased thereby to over 100 million c.ft. per annum.

In April, 1919, the Institution of Gas Engineers received a valuable joint contribution entitled "Report on the Coal-Gas and Electrical Supply Industries of the United Kingdom," by Sir Dugald Clerk, K.B.E., D.Sc., F.R.S., Prof. Arthur Smithells, C.M.G., F.R.S., and Prof. John W. Cobb, C.B.E., B.Sc., F.I.C.; and in this Report they said, referring to carbonization and the water gas process in the same apparatus:

> It would be a method of carbonizing and gasifying which made the minimum of demand on external heating . . . by this method a thermal efficiency on carbonization of 75% to 80% would probably be obtained.

This considered expression of opinion from three such distinguished authorities encouraged me to persevere in searching after an ideal not easily attained. Progress has been slow and difficulties many, but since my two sons, H. S. Moore and W. S. Moore, became old enough to take an active interest in the quest they have overcome technical obstacles which had hitherto retarded progress, and the new Moore gas plant at Burnham-on-Sea goes far towards fulfilling my dreams of fifteen years ago.

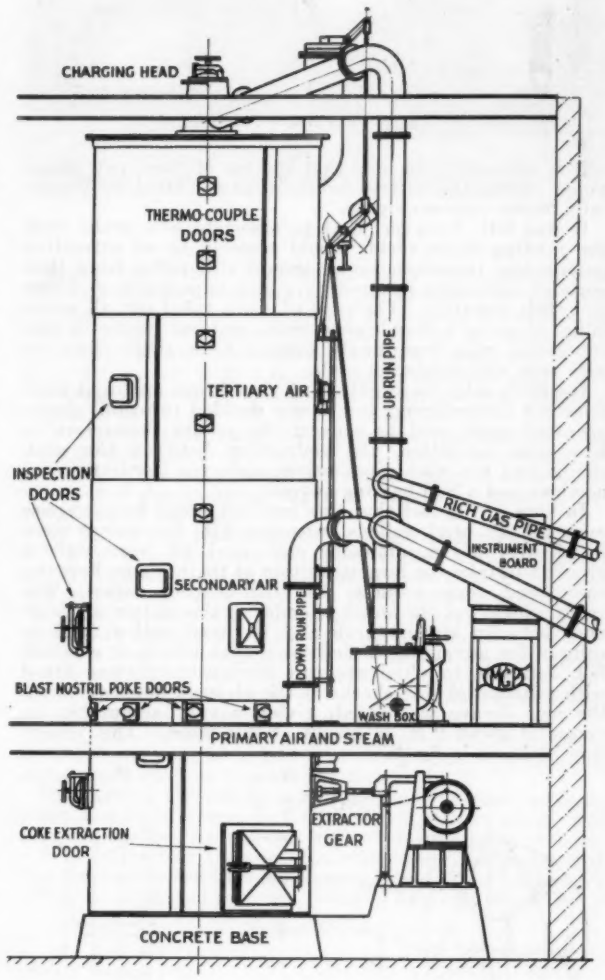
The Moore Gas Plant.

A typical Moore gas-making machine consists essentially of a metal shell containing a vertical coal gas retort superposed upon a water gas generator, the retort being surrounded by a series of twin regenerative heating chambers. Means are provided for feeding coal into the top of the retort and for extracting quenched coke at the base of the water gas chamber.

The coal in the retort is carbonized by:

(1) Intensely hot water gas passing up through the retort and mixing intimately with the coal gas produced therein.
(2) Direct radiant heat from incandescent coke in the water gas zone.
(3) Stored-up heat penetrating through the walls of the retort from the chequered regenerative chambers surrounding it.

The retort is built of segmental refractory materials, suitably tapered, and the outer circumference is fluted, or corrugated, or honey-combed, in order to present the largest possible surface contact with the heating "blow" gases.



There is no external producer, as the necessary heat for distilling the coal in the retort is provided by the intermittent admission of air under pressure into the air circulating duct, whence it passes through a number of tuyeres into the bottom of the water gas chamber, and this blast brings the hot coke therein up to the necessary high temperature. The resulting producer gas travels out through nostrils at the base of the retort and thence up and around the outside of the retort *via* the twin series of regenerative chambers and out through the stack valve to the atmosphere, or to a waste-heat steam boiler, as the case may be.

Secondary and tertiary air is admitted at suitable points, to ensure proper combustion of the "blow" gases.

Each "blow" is followed in due sequence by a gas-making "run," and during each run steam is injected into the body of very hot coke to produce water gas, which travels up through the retort and blends with the coal gas. The resulting composite gas is caused to flow from the top of the retort to the hydraulic valve box, and thence through the condensers, &c., to the gasholder. The

" blow " and " run " cycle can be altered at will, according to the quality of gas required.

An automatic air accelerator increases the volume of secondary and tertiary air during the period of each " blow," to ensure more complete combustion of the blast gases, with consequent shortening of the " blow " periods. A similar apparatus automatically reduces the volume of steam admitted during each " run," thus preventing an excess of carbon dioxide in the town gas.

If desired, the chequered heating chambers around the retort can be used for carburetting gas oil or other liquid enrichments. In that case the oil is sprayed into one of the twin series of chequered chambers during part of each " run," throughout a shift, but during the next shift the oil is sprayed into the other set of chequered chambers. Thus, while one set of chambers is being used for carburetting purposes, the other twin set is being de-carbonized by the " blow " gases.

All the different controls are mechanically operated; hence the whole process of gas making proceeds for hours at a time without need for any manual attention.

Our No. 1 gas plant at Burnham-on-Sea is not mechanically operated and is now kept as a stand-by. It produced about 60% of the total gas output to the town for 4½ years, until the improved No. 2 plant replaced it last year.

Some of our works mains, &c., are not large enough to allow both the Moore plants to be used simultaneously, and neither unit is large enough to provide all the gas required for the town. We therefore use two old beds of horizontal " sixes " to make up the output. These are kept on 8-hour charges winter and summer, and the more elastic Moore process provides all the additional gas required, varying between 25% and 75% of the total daily make, according to the seasonal requirements. The old retort house is partly under sea level and inefficient, but despite the uneconomical effects of using these horizontals in conjunction with the Moore process our working results over a period of twelve months were as under:

TABLE I.

Coal carbonized	2,548 tons
Mixed gas made	54,774,800 c.ft.
Mixed gas made per ton of coal	21,849 c.ft.
Average quality of gas made	454 B.Th.U.
Therms made per ton of coal	99·2
Coke for sale per ton of coal	4·2 cwt.
Tar for sale per ton of coal	9·5 gallons
Crude mineral oil per ton of coal	2·0 gallons

Best South Yorkshire coal used.

During the nine months ended Sept. 30, 1933, we used a proportion of cheaper coal, and the results were as follows:

TABLE II.

Coal carbonized	1,828 tons
Mixed gas made	35,775,900 c.ft.
Mixed gas made per ton of coal	19,571 c.ft.
Average quality of gas made	455 B.Th.U.
Therms made per ton of coal	89
Coke for sale per ton of coal	4 cwt.
Tar for sale per ton of coal	9·9 gallons
Crude oil per ton of coal	about 2 gallons
Carbonizing wages per 1000 c.ft. of gas made	4·17d.

Class of coal used, 70% Yorks., 30% Dean Forest.

Prior to installing our first Moore plant we used a blue water gas generator in conjunction with our horizontal retorts, and the following results were obtained over a three months' period:

TABLE III.

Mixed gas made per ton of best Yorkshire coal	14,109 c.ft.
Average quality of gas made	460 B.Th.U.
Therms made per ton of coal	64·9
Coke for sale per ton of coal	5·7 cwt.
Tar for sale per ton of coal	12·0 gallons
Carbonizing wages per 1000 c.ft. of gas made	8·98d.

During a three months' period corresponding with the foregoing, the undernoted results were obtained from horizontals only:

TABLE IV.

Coal gas made per ton of best Yorkshire coal	12,502 c.ft.
Average quality of gas made	475 B.Th.U.
Therms made per ton of coal	59·4
Coke for sale per ton of coal	5·6 cwt.
Tar for sale per ton of coal	11·0 gallons
Carbonizing wages per 1000 c.ft. of gas made	8·82d.

Our Undertaking on account of its size is neither staffed nor equipped for making exhaustive tests of the Moore system, and for the reasons already stated it has not been possible to make long-period separate tests on the lines of the preceding working results. However, some three months after our No. 2 unit had been started to work I was able to arrange for a series of short-period tests, to be carried out by competent gentlemen representing the contractors, Messrs. Andrew Barclay, Sons, & Co., of Kilmarnock. These gentlemen brought all the necessary apparatus for carrying out the tests so far as the local conditions permitted.

I wish to point out that we have no meter to measure the Moore gas separately at Burnham-on-Sea. The figures obtained were thus subject to the qualification that the quantity of gas made was *calculated* in each case, based upon the capacity of the 50,000 c.ft, relief gasholder per sheet and per rivet, with occasional corrections for temperature and barometric pressure.

The quality of the gas was frequently tested in a standard portable calorimeter, and samples of the gas so tested were separately checked in an Orsat complete analysis apparatus. These tests were made primarily for the information of the contractors, and in the circumstances an approximate figure of the quantity of gas made had to suffice, although every precaution was taken, I believe, to ensure reasonable accuracy.

GOOD WORKING RESULTS.

The working results obtained were extraordinarily high, but as I am not in a position at present to prove their accuracy I will leave it at that.

This much has been proved without a shadow of doubt:

1. The No. 2 Moore machine at Burnham-on-Sea has been working daily for over twelve months.
2. It can produce in a one-stage operation (from suitable coal) coal gas, or blue water gas, or carburetted water gas, or mixed gas.
3. It will produce (from suitable coal) coke of any desired volatile content, or all the coke can be gasified if preferred.
4. Tar, ammoniacal liquor, and small quantities of crude mineral oil are recovered by condensation, after the gas leaves the generator.
5. The gas is highly combustible, has a very low content of inerts, causes no naphthalene troubles, possesses the characteristic odour of coal gas, and has no higher percentage of carbon monoxide than any other combustible gas of the same calorific value.
6. The retort never needs to be scurfed; " poking down " the charge of coal in the retort is needed very rarely; " clinkering " is never needed if the plant is regularly worked three shifts per day (half-an-hour per month will suffice to remove any clinker formed when the plant is operated intermittently).
7. The plant is mechanically operated, and can be worked continuously, or shut down at night like a factory if preferred.
8. The plant can be started up from cold into full work within four hours.
9. The works boiler-man on each shift attends to the plant as may be required in addition to his ordinary duties.
10. The No. 2 plant at Burnham will produce 300,000 c.ft. of blue water gas per 24 hours, or 150,000 c.ft. of 400 B.Th.U. gas per 24 hours, or smaller quantities of richer gas, depending upon the quality desired.
11. The ground space occupied by the No. 2 plant at Burnham, including all machinery, and the 7 ft. 6 in. diameter generator complete, measures only 22 ft. by 20 ft.

Typical Analyses of Moore Gas.

—	Test No. 1.	Test No. 2.	Test No. 3.
	%	%	%
Carbon dioxide	3·6	4·7	7·0
Hydrocarbons	2·2	1·6	0·6
Carbon monoxide	21·1	28·1	28·1
Hydrogen	53·4	50·7	52·0
Methane	17·5	13·0	9·7
Nitrogen	2·2	1·9	2·6
	100·0	100·0	100·0
Gross calorific value, B.Th.U.	466·0	420·64	365·0
Content of inerts, %	5·8	6·6	9·6

NOTE.—The calorific values are based upon a formula given me by the late Mr. Tom Settle, which represents the average of numerous published formulæ, as follows:

	B.Th.U. per c.ft.
CO	322
C_nH_m	2329
H_2	320
CH_4	1005

Although we do not measure the Moore gas separately at Burnham, we do keep a separate account of the wages, &c., in connection with the process. We estimate the " make " of Moore gas. On this basis the approximate

cost of producing this gas is slightly over 1s. 0½d. per 1000 c.ft., without crediting residuals, made up as follows:

Coal	9·92 pence
Oils, &c.	0·22 ,,
Labour	2·42 ,,
	12·56 pence

The item for labour includes all the wages of the works boiler-men (although much of the steam they produce is used for general works purposes), all labour on handling coal and coke for the plant, and all labour on repairs and maintenance. "Oils, &c.," includes all lubricants and all renewals and materials for maintaining the plant in good working condition.

Plant Erected by Works Staff.

The No. 1 plant at Burnham was erected by our own workmen and started to work in April, 1928. It was built chiefly of second-hand materials, and occupies a portion of an old purifier house. After having provided the greater part of our daily gas output for 4½ years we shut it down for internal examination and repairs. We found the retort as good as new, but after minor general repairs the plant is now kept as a stand-by, ready for use on short notice should it be required. The total costs of these repairs did not exceed £25.

The No. 1 plant was such a great success that my Directors unanimously decided to erect a new house and a complete new Moore plant, and this new plant was started to work at the end of the summer of last year.

We had already installed a new works boiler and a new 100-ft. brick-lined steel chimney. The chimney was provided with two branch connections for the stack pipes from the two Moore gas generators. The contract for the new plant was placed with Messrs. Andrew Barclay, Sons, & Co., Ltd., who gave us a first-class job. The new plant is in a steel-framed, brick-panelled house, with a lean-to roof covering the boiler house. The roof of the No. 1 plant house was removed and replaced with "Big Six" red corrugated asbestos sheeting on steel framework to match the roof of the new plant house. The new house has the appearance of a small vertical retort house, and is fully equipped with all modern requirements for facilitating the work of gas-making, including an overhead double bunker for coal and a 10-ton per hour bucket elevator. Provision has been made for fixing carburetting equipment to both the generators, and thus we are able if necessary to enrich the gas to any desired extent at maximum output; but at present we can easily meet all demands both as to quality and quantity from the use of coal only.

At maximum output the two Moore generators at Burnham are capable of producing 500,000 c.ft. of lightly carburetted mixed gas per 24 hours, and the cost of the whole combined installation was under £6000.

Burnham-on-Sea Gas-Works were noted for good working results long before I became connected with the Company. But after I took over the management we began to feel the effects of increasingly keen competition from a large electricity undertaking whose ramifications cover half the county. We realized that good ordinary working results might not be good enough, and my Directors also realized that if the town continued to grow the carbonizing equipment at the gas-works would soon become too small to meet increasing demands for gas.

The installation of our Moore gas plants has helped us meet all demands for gas for many years to come; and the big saving effected in the costs of gas manufacture, directly resulting from the use of the new process, enabled us to adopt progressive methods of service which have proved invaluable in combating opposition.

Compared with the average costs of gas production during the five years prior to 1928 (horizontals *plus* blue water gas) the saving during the subsequent five years, 1928 to 1932 (Moore *plus* horizontals), amounted to the large sum of £9500, an average of £1900 per annum. This saving enabled the Company to:

1. Maintain very satisfactory dividends (£10 12s. 6d., £7 8s. 9d., and £6 7s. 6d.).
2. Open a well-stocked modern gas showroom.
3. Greatly improve their works and property.
4. Almost double the output capacity of the gas-works.
5. Reduce the average price of gas to consumers by 1d. per therm.
6. Introduce a scheme of "free" maintenance of all gas fittings, &c.
7. Modernize nearly all the Company-owned cookers, slot installations, &c.
8. Despite strenuous competition from "penny-per-unit" electricity, acute local effects of economic depression, no street lighting by gas, and no industrial consumers, the Burnham Gas Company distributes over 50 million c.ft. of gas per annum in a town of less than 6000 inhabitants, and sells 30,000 c.ft. of gas per domestic consumer per annum.
9. The Burnham Gas Company is now in a stronger position financially and otherwise than ever before.

In conclusion, it is hardly necessary to mention that this paper is not intended to be a scientific treatise, but merely a simple general statement of how a scientific theory has been translated into actual practice with considerable benefit to both the Gas Company and the community it serves.

Notwithstanding all its defects, I hope this modest contribution to your proceedings will be favourably received and draw competent attention to the great potentialities of coal carbonization by internal heat.

DISCUSSION

The President said that in view of the increased taxation of motor vehicles it behoved all engineers to consider carefully the cheapest methods of handling their raw material, and he thanked Mr. Clark for having given at least three very useful suggestions in this respect. The paper by Mr. Moore opened up a vision, to the smaller works at any rate, of a very economical method of making gas. As one who was fairly intimately connected with the Burnham Undertaking, and who had seen the plant there, he must say that the finances had been greatly improved.

Mr. F. Blackburn (Plymouth), commenting on the fact that Mr. Clark was still using steam wagons at Plymouth, and that such wagons were going to be taxed more highly, although they used home produced fuel, asked if Mr. Clark was considering the fitting of pneumatic tyres to his wagons, or whether he was contemplating obtaining new wagons. With regard to the dumping of coal to a height of 21 ft., he asked if there were any troubles resulting from that. Finally, he asked what were the dock dues.

Col. H. W. Woodall, in congratulating Mr. Moore, said that anyone who was carrying out original work and producing improved results in the carbonization of coal was deserving of the thanks of the Industry. They had proceeded very far, with the aid of science, in perfecting the methods to which the Industry was accustomed, but he suggested that it was necessary to look for some really radical change if carbonizing methods were to be carried much beyond the stage reached to-day. A small works had not the advantages of unlimited capital, but those concerned with small works had the distinct advantage of personal contact and personal working among their colleagues. Col. Woodall recalled that the late Sir Arthur Duckham and himself, many years ago, had started working on very much the same idea as that developed by Mr. Moore, but they had not the courage or the capacity to bring it to perfection, and they had changed to a simple form in which they had left out the production of water gas, and produced 14,000 c.ft. of gas per ton of coal and 9½ cwt. of coke. The possibilities of increased efficiency by applying heat internally, instead of wasting some of it externally, was well worth investigation.

Gasification Plant at Mill Hill.

Mr. F. J. Pearce (Mill Hill) said that he was producing a proportion of his gas by a complete gasification method based on the same general principle as that of Mr. Moore, though the plants differed. Mr. Moore had described his process as coal carbonizing by internal heat; that was not quite the same thing as completely gasifying coal by internal heat, because diagrams of Mr. Moore's process showed that the carbonization was carried out by the hot blast gases round the walls of the retort, whereas in the plant with which he (Mr. Pearce) was familiar carbonization of coal was actually carried out by heat transmitted from the coal by the passage of gases through the coal chamber. This was effected by the circulation of the gas, on the back-run principle, and tests showed that there was a production of 180 therms per ton of coal.

It was unfortunate that Mr. Moore was not able to give the results of actual tests relating to the Moore plant as a unit by itself. According to the descriptive article published in the "Gas Journal" in May, 1933, the makers had carried out three independent tests, and he asked if Mr. Moore considered that the results obtained then were sufficiently accurate to be accepted as a general guide to the performance of this plant, because it appeared that the production figures were very high indeed, especially in the two latter tests. If one completely gasified a ton of coal—first by carbonizing a coal in a retort house and then converting the whole of the coke (about 13 cwt. per ton) into blue gas—the total number of therms one could possibly obtain per ton of coal was in the neighbourhood of 200. In the three tests by the makers of the Moore plant the total numbers of therms obtained per ton were 184, 223, and 240 respectively. Mr. Pearce suggested that the two latter results were far too high, and he would welcome Mr. Moore's remarks on those figures, because they did not seem to balance.

Mr. G. M. Gill (London) said that Mr. Clark's paper pro-

vided almost a model of the way in which preliminary work should be carried out before new plant was installed; the whole problem was examined systematically before the final decision was arrived at. The reference in the paper to trouble which had been experienced with crane chains reminded him that many years ago, at Wapping, he had experienced a great deal of trouble with coal crane chains under conditions somewhat similar to those described by Mr. Clark, there being very little clearance between the coal hopper and the jib of the crane. After a boat of about 1000 tons had been unloaded by the cranes, one could find material very much like filings underneath the chains, due to abrasion, which was becoming very dangerous. His solution of the problem at that time was to dispense with the crane chain greases he had been using, and to use a graphite grease, which had relieved the trouble. At the same time, he recognized that that was merely a palliative, and he would be glad to hear what had been done since.

The process described in Mr. Moore's paper would bear very careful investigation. It was interesting to note that Mr. Moore's method was to extract just enough of the coke to give the quality of gas required; when making a gas of about 460 B.Th.U. per c.ft., Mr. Moore extracted 4 or 5 cwt. of coke per ton of coal carbonized from the bottom of the water gas generator, which seemed to be a very sensible way of obtaining the quality desired.

It was interesting to note the statement at the end of the paper that, due to economies effected, Mr. Moore had been able to introduce a scheme of free maintenance of gas fittings. That was an ideal well worth working for, and was the sort of thing which would give real satisfaction to consumers.

Quality of Coke.

Dr. G. E. Foxwell asked what quality of coke Mr. Moore obtained and what appearance it had, because it seemed that if he were going to burn half the coke in the retort it would have a very high ash content or might even be coated with a little ash. He also recalled a statement made at the Institution of Gas Engineers that the coke after partial burning was very much more combustible, and he asked if Mr. Moore knew anything more about that aspect. Another question was whether the process used at Burnham had any real value for a works making gas of a higher calorific value than that at Burnham. It seemed that everything depended on how much water gas one could make; if one could not make very much more water gas one might as well use steam in verticals. Finally, he asked whether the operating results of this process were better for a small works than when using ordinary steaming verticals.

Mr. J. S. Thorman asked to what extent Mr. Moore extracted coke, and when the coke became salable for domestic purposes or when it became unsalable. He gathered that, as carbon was taken out of the coke, there must be a point at which the sale of the coke became difficult.

Mr. R. J. H. Clark (Plymouth), discussing Mr. Moore's paper, said that all appreciated the work and responsibility involved in more than doubling the gas output of the Burnham Works during the very difficult war period. Mr. Moore's success at that time, as well as more recent work in making the Burnham plant entirely automatic in operation, was deserving of sincere congratulation. Mr. Clark added that when he had visited the works it was a real pleasure to note how smoothly the sequence of operations was carried on. He asked how the blast was automatically controlled by the accelerators, how the crude oil was recovered separately from the tar, and whether the oil was suitable for carburetting purposes or was readily salable.

Mr. D. C. Cross said that the paper by Mr. Clark afforded a good example of how not to rush into the scrapping of old plant and not to take it for granted that it was absolutely necessary to install a new and modern plant in order to reduce costs. A good deal of old plant that could have been reconstructed had been scrapped in various places, and replaced by new plant, with the result that, instead of reducing costs, it had increased them by reason of the increase in the capital of the companies concerned. The conditions at Plymouth seemed somewhat similar to those at Poole, where the quay was several hundred yards from the works, and the difficulty had been overcome by the use of an overhead gantry which cleared other buildings. He asked if that system was impossible at Plymouth. At Poole they had crossed even roads, and buildings belonging to others, and the result of the system there had been to reduce the costs of handling probably to much below those at Plymouth.

The results of Mr. Moore's installation spoke for themselves, for it was stated that the savings from 1928 to 1932 had averaged £1900 per annum. He asked, however, how much of that saving was due to reduction of the price of materials such as coal and oil, because many works had effected quite considerable savings during that period by the reduction in prices of materials, and without installing new plant. He congratulated Mr. Moore, however, upon adopting a plant which really must be ideal, taking the hot coke from the carbonizing section into the water gas section without loss of heat, and utilizing waste gases. He had attained a great deal of his efficiency by saving heat. It was very commendable to have attained an efficiency probably higher than that of a good many modern plants, particularly in a small works.

Difficulties with Crane Chains.

A Speaker, enlarging upon Mr. Gill's remarks concerning the difficulties with crane chains at Wapping, said that when he had taken charge at Wapping (it was some years after Mr. Gill had left) he had found that the coal hoppers had been re-built; there had been no alteration of the crane, but the wear on the chains was no greater at that part where it had previously occurred than it was in any other part. He believed that result was due to the fact that, by reason of the construction of the hoppers, there was no chance of the grab swinging unduly. Each hopper was enclosed on two sides and the grab had to be swung in slowly and deliberately.

The President said he had calculated from the tables given by Mr. Moore, showing the working results of his plant for twelve months that there was a production of something like 170 therms per ton of coal carbonized on the mixed plant. While probably the results of the horizontals were not quite equal to the new plant of Mr. Moore's design, and therefore vitiated somewhat his final results, the President said that Mr. Moore's neighbours were producing on a somewhat similar plant —reckoned on the same scale of calculation—something like 204 therms per ton of coal carbonized, using a very similar coal. Those figures applied to steaming in verticals. It was fair to point out that Mr. Moore, by reason of the size of his works, had to make a portion of his gas in rather inefficient horizontal retorts.

Next the President asked what was the limit of the calorific value of the gas which Mr. Moore could produce on his plant in continuous working, because that was a crucial point. Perhaps scientific people would say that it would be impossible to produce continuously, with internally heated retorts, gas of more than 400 or 410 B.Th.U. per c.ft. Further, the paper indicated that about 75% of Moore gas and 25% of high quality horizontal retort gas was produced at times, whereas at other times there was 25% of Moore gas and 75% of horizontal gas. It would be interesting to know what effect that had upon the consumers, because it seemed that the constitution of the gases made in the two plants differed, and the consumers might have something to say about the variation.

The Authors' Replies.

Mr. Clark, replying to Mr. Blackburn, said that the licensing cost of the steam vehicle was about £60, but he understood that under the new licensing arrangement the cost would be £140 or £160 next year, so that something had to be done about it. Alteration to tyres would not help, he was afraid. He was investigating seriously the introduction of a Fordson tractor with a three-way tipping trailer, capable of carrying a net load of 8 tons; the tax in that case, he hoped, would be only about £25.

It was true that the crane would stack coal to a height of 21 ft.; it was the usual practice to stack to a height of 16 ft. or 18 ft., but as the coal was washed and graded and of nut size, he would not hesitate (on grounds of building-up heat) to stack in the open or in store for any reasonable period to a height of 21 ft. He had not experienced trouble since run-of-mine coal had been discontinued.

The dock dues were 6d. per ton. He did not include them in the paper because he considered they were not within the scope of " cost of handling " by mechanical means.

With regard to the wear of crane chains, he said that at Plymouth the trouble was not due to mechanical wear and tear—*i.e.*, attrition—but to the locking together of about four links, which was the length of the chain between the jib-head pulley and the hood of the grab, when the grab was suspended high enough to clear the tops of the hoppers. The height of the jib, however, had been increased, so that there was a greater number of links between it and the grab, and the trouble was overcome.

Replying to Mr. Cross, he said that he had considered the possibility of installing mechanically-operated plant between the quayside and the works—both Mr. Hoyte (his predecessor) and himself admired the way in which the Poole Works were run—but they had come to the conclusion that at Plymouth, unfortunately, the difficulties could not be solved in that way.

Mr. Moore, replying, said that he was not hampered in respect of capital at Burnham, for the savings effected on the first of the Moore plants were sufficient to pay for the plant in eight months; the same applied to the second. A saving of £1900 a year, in any case, would soon wipe off a bank overdraft of a few thousand pounds. Reductions in the prices of coal had entered into that average saving of £1900 per annum, but only to a very small extent, not sufficient to affect the figure seriously. Because he could use cheaper coal in this plant he was able to secure offers for the better coal at lower prices than formerly, so that it was chiefly due to the use of this plant that coal prices were reduced.

Replying to Mr. Pearce, he said the principal source of heat for making the composite gas, for carbonization or distillation, was the hot water gas which mixed intimately with the coal gas in the retort. The fact that there was not a constant external furnace consumption of coal or coke was one reason for efficiency. He had no reason to find fault with vertical retorts, but one could not readily put an up-to-date equipment in an old-fashioned works without incurring capital charges, which would have to be included in the price of gas sooner or later. Probably verticals would do the same as this plant, but the installation charge would be three or four times heavier, so that it would be three or four times more difficult to achieve the same financial results. He did not claim any better results than with verticals, but his results were as good as most people were getting from verticals, though not as regards coke.

He had not mentioned in the paper the results obtained by Messrs. Barclay (published in the " Gas Journal ") because he had not taken part in the tests, but he felt quite sure that Messrs. Barclay had done everything possible to obtain accurate results, and he believed they were accurate.

As far as coke was concerned, he simply put coal in at the

top and extracted coke of any desired volatile character from the bottom, quenched automatically, and it could be produced according to the demand. If he had control of a large works he would like to have a battery of Moore gas generators, which could be supervised by one man, who would have little to do; he would like one generator producing coke of a given quality (perhaps a product such as "Coalite"), another producing boiler fuel, another working on complete gasification, and so on, depending on the condition of the residuals market. A gas-works manager working on this process could control his coke market; he personally could control coke sales in the Burnham neighbourhood, and disposed of his own coke as well as the surplus from a neighbouring undertaking. Seven years ago, coke was sold at 18s. to 20s. per ton, but 35s. was more like the present figure at Burnham. Both in winter and in summer the production just met the demand; Burnham coke was noted in that part of the country, and he could always sell it at a price 10s. per ton higher than that of imported coke.

Inasmuch as he did not use oil, he did not debit any savings on oil against the average saving of £1900 a year.

In explaining how the blast was controlled, he said that primary air was introduced for the blow, and secondary and tertiary air were increased for a short period of the total blow period. The theory on which he had worked was that at the beginning, when the primary air was started, the coke was comparatively cool; as the primary air passed through it, it became increasingly hotter. The secondary air was increased for one minute in every five—or one in every eleven when making a rich gas. The fewer the number of blows the greater the number of runs, and, therefore, the greater the quantity of the gas made.

The production of the oil was rather like magic, and he could not take credit for it. The relief holder was a long distance from the plant. After the gas had been subjected to the cooling and scrubbing processes, and tar was extracted, the gas travelled underground to the relief holder, and on the way it was discovered that there was oil. The oil was kept separate from the tar and was sold at 1s. 6d. per gallon; the price obtained for the tar was 1¾d. He knew of no satisfactory explanation for this production of oil separately.

Replying to the question as to the limiting calorific value, he said that unfortunately he had not been able to carry on very long at a high figure. Up to Oct. 1 the calorific value was 450 B.Th.U. When testing to find out what the plant could do the gas became too rich, so that he could not carry on for more than three days. On the first of those three days, however, the average production was 180·23 therms per ton of coal and the average quality 446·45 B.Th.U.; on the second day, 182·62 therms and 452·8 B.Th.U.; and on the third day, 180·56 therms and 488·9 B.Th.U.

He had not experienced difficulty with consumers due to varying constitution of the gas. The coal used was the very best coking gas coal.

Votes of Thanks.

On the motion of Mr. D. C. Cross, seconded by Mr. Blackburn, a vote of thanks was accorded the authors for their papers.

Mr. L. J. Langford proposed a hearty vote of thanks to the President, which was seconded by Mr. G. M. Gill, and carried with acclamation.

The President assured the members that he had enjoyed his work as President, and that if he had given a measure of satisfaction he was more than delighted.

Lighting of Arterial Roads by Gas*

By A. M. Bell, Public Lighting Superintendent, Tottenham and District Gas Company

Arterial roads as we know them are constructed for specific purposes—namely, to make short travelling distances between towns, to divert traffic from busy shopping centres, or to by-pass towns. In my paper, I am going to single out one of these arteries, the Great Cambridge Arterial Road, which runs through the centre of the area of supply of the Tottenham Undertaking; and for the remainder of my paper I shall refer to this artery as "The Road."

The Road was opened to traffic approximately ten years ago. The overall width is made up as follows: 16 ft. footway, 24 ft. carriageway, 10 ft. grass verge, another 24 ft. carriageway, and another 16 ft. footway. The down road has not yet been completed and is at present a grass sward. The Road passes through the areas of five local authorities and two counties, and in all is 10¾ miles in length, cut in places by main and secondary cross-roads, and in one place by the North Circular Road. When The Road was first opened one could traverse the whole length practically without passing a house, factory, or building of any sort, and certainly no street lamps. Traffic was extremely light, and there was no necessity for point policemen. It was not long before the existence of The Road became widely known and gradually the traffic increased and house building commenced. Then it became necessary to have policemen at various junctions, and a few street lamps were erected at dangerous crossings. The Road grew, more houses were erected, then a Council housing estate and some factories were built, and, as was only to be expected, accidents occurred. Sample gas and electric lamps were erected for the Council's inspection in one area, but it was not until 1927 that any public lighting scheme matured. This was carried out in Tottenham, where twenty-seven 6-light upright fixing gas lamps were erected on 14 ft. columns, carrying the light source to 16 ft. above ground level, the standards being spaced 100 ft. apart in line on the grass verge in the centre of the road. It was shortly after this time that trees were planted 60 ft. apart on each footway throughout the length of The Road. Traffic had now increased enormously, and in a comparatively short stretch it became necessary for point policemen to be placed at four crossings.

Illuminating Point Policemen.

The illumination of these policemen was one of the first real difficulties to be tackled, and in three instances this was overcome by erecting two gas lamps at each junction, each lamp fitted with a bull's-eye which directed a beam of light on to the officer; but in the fourth case we experienced trouble. In the first three cases there were buildings skirting The Road, but in the latter, which is at the junction of five roads, conditions were different, for here there were no buildings at all. Lamps were erected, positions altered, spot lights attached, and many experiments made, but the policeman was still not visible at any reasonable distance, for his dark uniform was lost in the dark background. The trouble was obvious, but how to overcome it was another matter. I endeavoured to persuade the owner of some vacant land to give permission for an advertising hoarding to be erected which would act as a background for the policeman, but such permission was not granted. At big expense this great junction was altered, all roads were thrown open wide, and an island refuge was erected in each neck with a 10-light gas lamp and two bollards fitted with reflex boxes. This alteration tended to slow up the traffic at this point and make traffic control easier. It was at this time that another Council decided to light sections of the road in their area, which were skirted by houses, and extend the lighting as building proceeded. Traffic was by this time increasing rapidly and accidents were numerous—in fact, a first aid hut was erected, to which was attached a motor ambulance, and I understand that in one day the volunteers attended no fewer than seven separate accidents.

Gas Lighting Extended.

I have given the above details to show how rapidly conditions changed from the time when the road, practically deserted, wound peacefully through fields and open spaces, traversed by few and inhabited by none, to the present day when no fewer than 4927 vehicles were officially recorded as having passed one point in 16 hours. Changes are still taking place; the point policemen previously mentioned have all been withdrawn, and traffic-operated signals have been installed in their places. The huge junction which cost so much to open up and widen is again being altered, and the wide open roads are being narrowed for the construction of a gyratory traffic system. With the advent of this alteration one more Council has adopted gas lighting for the whole of its area, and another completed the lighting of its section.

And now, to sum up the evidence, as I have said this road passes through five different Council areas, and the following details are interesting for comparison:

Council.	Length of Road.	No. of Lamps Required.	Population of Town.	Rateable Value.
	Yards.			£
A . . .	2035	63	158,800	883,687
B . . .	375	9	54,520	457,673
C . . .	4700	101	78,800	437,074
D . . .	5280	120	67,869	505,869
E . . .	5715	130	14,651	80,917

The Road is primarily used for vehicles, and as it by-passes all shopping centres, it cannot be said to bring trade to any neighbourhood. On one section only is it completely built upon. On section E there is practically no

* From a paper before the Public Works, Roads, and Transport Congress (1933), Nov. 14.

building at all, and it will be noticed that this Council, with the lowest rateable value, has the longest section of the road to light. This is an exceedingly heavy burden for the ratepayers in that district to bear, and emphasizes the reasonableness of my contention that in such cases the authority through whose area the road passes should receive some assistance in meeting the costs of lighting. The death roll on The Road is heavy, and surely this fact alone should emphasize the necessity of good and adequate street lighting. The local Councils are the lighting authorities, and the ratepayers are expected to foot the bill for lighting a road which is of little or no interest to them.

Importance of Good Street Lighting.

I contend that good street lighting is as necessary and as important as any other public service, and is one of paramount assistance to the police in their work of maintaining law and order. The cost of installations and the annual expenditure cannot be borne to the same extent by a country town as it can by a wealthy city, neither can a comparatively few residents be expected to contribute by voluntary taxation a large sum, when they already pay for public services. I consider that all roads in the country should be graded, the necessary lighting correspondingly graded, and the expense paid out of a common fund to be contributed to by all local and county authorities, and to include a considerable contribution from the Road Fund.

To all intents and purposes the lighting of The Road so far is uniformly carried out by clock-controlled 6-light No. 2 upright fixing low-pressure gas lamps with mantles in staggered formation, erected on 14 ft. columns spaced 130 ft. apart in line in the centre of the road. The average ground illumination is 0·25 foot candle, the maximum 1·22 foot candles, and the minimum 0·055 foot candle, height spacing ratio 8·125—1, and the diversity factor 22·18. Class "F," B.S.I. Specification.

All important road junctions are illuminated by 10-light lamps of the same pattern and mounting height. The more recently fixed lamps are fitted with 24 in. diameter flat enamelled steel shades and multi-faced reflectors clipped on to the uprights. These latter attachments add considerably to the efficiency of the lighting. There has been considerable criticism of the lighting. It has frequently been said that it is too good and too lavish, also that the road is illuminated like a greyhound racing track. However, in spite of everything, I have never heard an adverse criticism. The light is soft with a total absence of glare, and in this connection I should like to mention how deceptive "light" is. As an instance I will refer to an experiment which I have carried out on more than one occasion when taking people to inspect installations. After first inspecting lamps in a road lined with houses on both sides, and then inspecting a road with open fields on either side, the opinion expressed is always that the lighting of the street lined with houses is the better, when actually, as proved by the photometer, it is far from being the case. An installation in one street might be considered admirable, but an identical installation in another type of street would be considered poor. I have found that the average man in the street thinks that if he sees a glare, that it is a good light.

Lighting an Arterial Road.

I now propose to touch on one or two details which must be considered when preparing a scheme for the lighting of an arterial road. Unfortunately, for the reasons stated above, in the majority of cases the first points are capital cost and annual charges—these two items as a matter of necessity must be cut down to the lowest possible figure. The next point is to look into the future and ascertain what buildings (if any) will be erected on either side of the road, and whether the road at some future date will have to be widened. If there is no possibility of shops or houses, a high grade of illumination must certainly be provided, for no aid from reflection or assistance from outside sources will be obtained.

Another necessity is uniformity of lighting over the whole length of the road, for there is nothing so dangerous or trying to drivers than to run from a well-lighted section into an unlighted black patch or into another section with a totally different scheme which may give bad visibility.

There are several pitfalls which must be guarded against. The chief of these, I consider, is sections of road lighted only on the inside of a bend. A dry section of road so lighted may not appear troublesome, but directly the road becomes wet we get specular reflection or streaks of reflected light running from the observer to each light source, and as the lights would be situated away from the bend of road, the whole surface would appear to be black with no possible hope of reflection or silhouetting as an aid. To overcome this difficulty, I say definitely that, however high or low the category of illumination may be, lamps placed on both sides of the road are necessary. This question again arises on highly polished road surfaces.

Now I am coming to a point on which I personally hold strong views. I consider the minimum height of the light source recommended under the B.S.I. specification is infinitely preferable for this type of road lighting on account of silhouetting, which, although it should not be necessary, is to my mind a very great assistance to drivers of vehicles in rough weather, mist, or fog.

Another difficulty with which a public lighting engineer has to contend is the presence of trees planted close to kerbs. On The Road trees were planted 60 ft. apart 3 ft. in from the road face of the kerb. The trees are of the large type—poplar, chestnut, &c.—and in the few years that they have been planted, some have already grown from 20 to 30 ft. high. In a section of The Road, in the early days, one of the Councils decided to have lamps erected on the footways, and the lighting was quite good, but the trees grew to such an extent that practically all road illumination was cut out, and at considerable expense the position of the lamps had to be moved to the centre of the middle grass strip.

Another common fault is to suspend a lamp in the centre of a road junction immediately over a policeman. This method is entirely wrong in itself, for the light from the lamp merely illuminates the policeman's helmet, and the majority of the figure is in shadow. It is agreed that a lamp suspended over the centre of a wide road junction is certainly very advantageous as a means of obtaining uniformity of road illumination, but it is necessary to have the assistance of side lights to illuminate a point policeman. Here again a screen or background is a great aid.

On The Road there are a large number of signs such as "Cross Roads," &c. If such signs are considered necessary by day, how much more necessary is it that they should be illuminated by night? If a road is not lighted at all, I contend that it is imperative that at least every road sign should be illuminated, and I have used every endeavour to further this point; but here again comes the question of the responsibilities of authorities. So far I have only been successful in a very few cases, although it is a subject which I have been trying to emphasize for years.

The lighting of refuges and bollards or guard posts is another item which has received our special attention. A refuge is an obstruction deliberately placed in a thoroughfare, and for this reason alone the greatest care must be taken in selecting the means for lighting it. The bollards should also be illuminated to give every assistance to drivers of vehicles, and reflex signs can be adopted with great advantage.

While considering the subject of refuge lighting I would like to mention a few details which I consider should receive every attention in the lighting of a "round about" or gyratory system. In a scheme of this nature many signs or directional notices such as "Keep Left" or "Turn Left" are necessary, and on most arterial roads the centre island, which, although guarded by railings, bears no further obstruction. All lights should be shaded from every point of visibility other than in the road or island refuges, thus leaving the illuminated signs clear and distinct.

Until comparatively recently dark patches were visible between lighting units. These dark patches are in reality contrasts of light between the maximum and minimum road illuminations. To overcome this unevenness of illumination, reflectors or refractors are being found of great assistance, but care must be exercised in the selection of one or the other, or of the combination of both, in avoiding too directive light which will produce "spot light" effects. There is nothing worse to a driver than having to drive through a road and constantly to have his attention distracted by flashes of light, especially in bad weather when windscreens are wet and each drop of water acts as a bull's-eye momentarily to blind the vision of a driver at each flash. Reflectors and/or refractors when properly applied are of very great assistance in obtaining a more even distribution of light.

Maintenance of Lamps.

The question of maintenance is of considerable importance. Nothing is more necessary in street lighting than the very highest degree of maintenance service. Nothing does more to harm the merits of either gas or electricity than bad maintenance. A drop of 20% in efficiency may easily occur by a comparatively small amount of dust and dirt on glass or reflectors, while anything up to 50% efficiency drop may be experienced after neglect of cleaning for a period of a few weeks. Dirty glass or dirty reflectors ruin the efficiency of any installation. Good maintenance pays for itself. While on the subject of maintenance, there is one point which is not widely known—that a gas mantle, instead of diminishing in illuminating power, often

actually increases in efficiency up to 1000 lighting hours; and so with good maintenance a gas installation should not deteriorate.

The standard of technique of modern street lighting is becoming exceedingly high, and it is essential that every public lighting engineer should be thoroughly experienced in all its branches—not merely conversant with any one form of illuminant, but trained to the technical and practical possibilities of each in the effort to attain a much higher standard of street lighting, which is so necessary in these days of fast moving traffic.

Discussion.

Mr. HAROLD DAVIES (Chesterfield) said that, while the technicalities arising out of the lighting of arterial roads could easily be overcome, it was the financial problem which offered the greatest obstacle. Arterial roads were built by county councils, but the lighting of them was under the control of the different local authorities, and very often parish councils were concerned who had no lighting powers at all. His experience had been that, while the local authorities interested in these arterial roads did not obtain any rateable value from the roads—as was frequently the case—there would never be any serious public lighting of that nature. Therefore, it seemed to him that some other method of approach would have to be adopted either through the Ministry of Transport or the county councils. Quite recently his own authority had occasion to approach a parish council with regard to the lighting of an arterial road, but was told that, as the transport authority, the Chesterfield Corporation should pay for the lighting, and the parish council would not provide a penny towards it.

Mr. G. H. WILSON (General Electric Research Laboratories) complimented Mr. Bell on the valuable work he was doing in drawing the attention to the problem of arterial road lighting. Dealing with general principles, Mr. Wilson spoke of the spacing of the posts, and suggested that the scheme described by Mr. Bell would never be a really satisfactory one, not because it was gas lighting, but because of the arrangement of the posts. In connection with some experiments which had been carried out with electric discharge lamps, and changing the arrangement of the posts from time to time, some rather striking facts resulted which demonstrated that lamps on both sides of the road, other things being equal, would always give better visibility than single side mounting. This had the effect of suitably illuminating the left-hand side of the road for the traffic going in both directions. Central suspension came next from the point of view of efficiency. He regretted the absence of any reference in the paper to a test of visibility, one criterion of which was the ability to see small objects in the distance. Experiments had been carried out with dummy cats, and it had been found that the visibility was greatly affected by the nature of the road surface. One portion of the road upon which these tests had been carried out had been treated with plain tar without any coating, and the reflection factor had been considerably reduced. He, therefore, urged local authorities to take into consideration the question of using road surfaces which would not spoil the lighting effects in the way that had been demonstrated by his experiments.

Importance of Road Surfaces.

Mr. J. M. WALDRAM said that street lighting engineers were realizing more and more that the brightness of the road rather than the illumination falling on it was the important factor, because it was quite possible to have a high illumination but a dark road surface, upon which practically nothing could be seen. The author had expressed the opinion that the minimum heights recommended in the B.S.I. specification were preferable to the maximum heights recommended in the same specification, but he joined issue with the author on that point, because height was an advantage, and with low posts there was a broad streak of darkness across the middle of the road. Mr. Waldram showed some photograph illustrating the differences in the illumination under dry and wet conditions with different types of road surfaces, and urged the need for the use of aggregates in road making which did not produce such a shiny effect in wet weather under the influence of the public lighting. Although it had been suggested that white chippings might be an improvement, this was not necessarily so.

Mr. W. M. ROGERSON (Worsley, Yorks.) took the stand that local authorities obtaining no rateable value from arterial roads, through the absence of property along them, should not be expected to provide funds for lighting these roads, which were so little used, comparatively, by the local residents. A case in point was the Manchester-Liverpool Road, three miles of which was in the Worsley district, and he suggested that as these roads were mainly for the purpose of getting people into the large cities, these latter should bear the expense of the lighting. Incidentally, Mr. Rogerson said the view in the North was that arterial roads need not be lighted at all.

Central Suspension Lighting.

Mr. H. C. GREGORY (North Metropolitan Electric Supply Company) said that there were so many practical difficulties connected with central suspension that it could by no means be regarded as a suitable means of lighting arterial roads. There were greater difficulties in maintenance, and there was also the necessity for two supports; and these alone were sufficient to put it out of consideration. The importance of the road surface in assisting illumination as regards visibility could not be stressed too much, and he suggested that experiments should be carried out to ascertain the best dusting medium for tarred roads. He also disagreed with the author's views concerning the height of the lamps. There was no reference in the paper to the modern type of fitting giving what might be called a uni-directional effect of the lighting with the traffic stream, but he believed that that type would become more and more appreciated in the future. A point to be remembered in this connection was that the first lighting of an arterial road was usually when the road was in an undeveloped state, and, therefore, it was of considerable importance to start with an installation of a type which could be augmented at a later date when development took place along the road. From that point of view the uni-directional type of lighting gave excellent results as regards visibility in what might be termed the half stage of lighting, and could be easily strengthened up when the time came for the road to be fully lighted.

Mr. F. C. SMITH (Gas Light and Coke Company) said that the different appearance of various aggregates under daylight and night conditions, mentioned by Mr. Waldram, was an important matter, and the appearance under night-light must be related with the spectrum of the particular light source under which the aggregates were seen. There could be no doubt that the colour of the light must have some influence on the appearance of these aggregates at night. With regard to the luminous output of gas mantles, and the suggestion in the paper that the output increased with time, it was the fact that up to a limited period of time—he would certainly not go to 1000 hours—there was an increase in the luminous output of a mantle as compared with the output when it was new. That period might easily be from 100 to 200 hours. Much work was being done to try to put into writing some of the things which some people thought were missing in the Gas Industry, and he believed that a very good specification for mantles would be issued in the near future, and that there would be available definite figures—some were already available—to enable them to determine more clearly such matters as depreciation.

Lighting and Accidents.

Col. OAKES (Safety First Association) gave some figures from an investigation of 3029 accidents, of which 1066 occurred during hours of darkness, which indicated that the number of accidents was much less where there was good artificial lighting. It was not unreasonable to suppose that lives would have been saved if there had been better lighting at the points where these accidents occurred.

Mr. L. T. MINCHIN (Gas Light and Coke Company) remarked that, whereas an animal was to be seen completely in a single patch of light, the human being, by reason of height, could not be expected to be evenly illuminated from head to foot. Therefore, it seemed necessary so to space the lamps that the overhead brightness of the field was increased; and this, at the same time, decreased glare.

Mr. W. J. JONES (Lighting Service Bureau, Electric Lamp Manufacturers' Association) suggested that it was not sound practice to attempt to do two things at once with street lighting. If traffic signals were illuminated by the street lighting, they were either unsuitably lighted, or the street lighting suffered. As a temporary measure for improving street lighting on arterial roads until the conditions justified two rows of lamps, perhaps it would be a good plan to adopt very long bracket arms in order to bring the light source more over the centre of the road. Recently, he had seen in Liverpool some roads similar to the Cambridge arterial roads, and the engineer there frankly admitted that at the earliest possible opportunity it would be desirable to have the lighting on the other side of the road also. Finally, Mr. Jones suggested that the ordinary method of floodlighting was unsatisfactory in the majority of cases, because it depended more on the bulk of the policeman than on the size of his arms. Therefore, he agreed with the author as to the desirability of floodlighting from the side, and, in addition, he suggested that there should be a considerable area so lighted, in order that a large policeman would stand silhouetted against the background.

Mr. S. B. LANGLANDS (Glasgow) submitted that arterial road lighting was a national question and not one for the individual authorities. If the Ministry of Transport recognized that these roads were arterial roads, then it should also be recognized that the lighting was a national problem. He was inclined to disagree with the view that improved lighting of arterial roads decreased accidents, because the moment a high degree of illumination was adopted, the motorist immediately put his foot down on the accelerator. In Glasgow there were some very well-lighted arterial roads, and he could not claim that the number of accidents on these was the least.

The Author's Reply.

Mr. BELL, in his reply to the discussion, said that many deputations had already been sent to the Ministry of Transport on the question of financial assistance in lighting arterial roads, but without success; and eventually in such cases where the lighting has been done it has been carried out at the expense of the local authorities. With double side lighting, the cost was increased and the difficulty of finances remained. As to the height of lamps, he agreed that on a long section of road higher posts were an advantage, but all he had said in the paper was that the height on a small section could be kept down to the minimum in the B.S.I. Specification. The height of the lamps on the Cambridge arterial road was 16 ft. Whether arterial roads should be lighted at all, as mentioned by Mr. Rogerson, depended upon the particular arterial road and the purpose for which it was used. If there were very few pedestrians using

it, then it might be left unlighted; but in that event the traffic signs should be lighted. Certainly, a road should be left unlighted rather than badly lighted. In reply to Mr. Jones, he said that the lighting of traffic signals should be independent of the road lighting so that it was not a question of trying to do two things with the street lighting. Referring to the increase in efficiency of gas mantles after a short time, Mr. Bell said that when he put in installations for street lighting he always fitted the burners with new mantles before an official test, but he also had found that when he made another test a day or two afterwards the efficiency had increased slightly as compared with the results given in the official tests. A closer study showed that this happened within the first 24 hours. The Gas Industry was now going into this question.

Yorkshire Junior Gas Association

ANNUAL MEETING

The 31st Annual Meeting of the Yorkshire Junior Gas Association took place on Oct. 28, at the Fuel Industries Department of Leeds University, when the retiring President (Mr. J. W. Wood, M.Sc., of Leeds) presided. Among those present were Mr. J. Bridge, M.Inst.Gas E., Engineer and General Manager of the Elland-cum-Greetland Gas Company, Hon. Secretary of the Manchester District Association of Gas Engineers and Chairman of the Yorkshire District Gas Education Committee; Mr. H. Singleton, M.I.Mech.E., Engineer and General Manager of the Huddersfield Corporation Gas Department, who read a paper which is published to-day; and Mr. H. J. Hodsman, M.B.E., M.Sc., F.I.C., Lecturer in Gas Chemistry at Leeds University.

On the motion of the Chairman, the meeting carried in respectful silence a vote of condolence with the relatives of the late Mr. H. W. Barker, of Leeds.

The President offered a hearty welcome to the following nine new members: Messrs. F. Telford and P. Marsden, of Huddersfield; F. McKerry and T. Smith, of Leeds; G. Fitton, of Dewsbury; G. W. Kay, of Selby; C. Mountain, of Castleford; R. Howarth, of Cleckheaton; and J. Brook, of Batley.

The HON. SECRETARY (Mr. John R. Firth, Bradford), presenting the annual report, stated that the membership of the Association was now 200, an increase of 3 during the year. Congratulations were extended to several members who had secured promotion during the year, which in some cases had necessitated removal from the Association's area.

The statement of accounts, presented by the Treasurer (Mr. T. G. Lewis, Leeds)—who during the year had succeeded Mr. H. Wilde, of Bradford, on the latter being transferred to Hornsey—showed a credit balance of £86, as compared with a balance of £85 at the beginning of the year.

The Report and Accounts were adopted, with thanks to the Secretary and Treasurer, on the motion of Mr. F. TELFORD (Huddersfield), seconded by Mr. E. R. B. FRENCH (Leeds).

NEW OFFICERS.

President.—Mr. B. Thorpe, Huddersfield.
Vice-Presidents.—Mr. Ralph Halkett, Junr. (Sheffield), and Mr. J. W. Carlton (Shipley).
Hon. Treasurer.—Mr. T. G. Lewis (Leeds).
Hon. Secretary.—Mr. John R. Firth (Bradford).
Assistant Hon. Secretary.—Mr. A. Smalley (Castleford).
New Members of Council.—Messrs. A. W. Elliott (Elland), F. Murphy (Barnsley), and D. T. Livesey (Doncaster).
Representatives on District Education Committee.—Messrs. J. W. Horwill (Bradford), B. Thorpe (Huddersfield), R. N. Webb (Leeds), and A. Wylie (Sheffield).
Hon. Auditors.—Messrs. A. W. Arnold (Bradford) and F. Lodge (Wakefield).

Mr. WOOD then inducted the new President to the chair.

Mr. THORPE expressed thanks for his election.

Mr. Thorpe then presented to Mr. Wood the Association's Gold Medallion, to hold as a permanent memento of his term of office in the chair.

Mr. WOOD, responding, said that the year 1932-33 had been one on which he would always look back with great pleasure and pride.

A vote of thanks to the retiring President and officers and Council was carried, on the proposition of Mr. W. CARTER (Hemsworth), seconded by Mr. F. FIRTH, F.I.C. (Leeds), to which Mr. WOOD briefly responded on behalf of his fellow officers.

Mr. J. BRIDGE, Engineer and General Manager, Elland Gas Company, speaking in respect of the District Education Committee, of which he is Chairman, said he wished to pay tribute to the loyal and consistent service given the Education Committee by the representatives of the Yorkshire Junior Gas Association, and particularly to that of Mr. Horwill in the Secretaryship of the Committee.

A vote of thanks to Prof. J. W. Cobb and the authorities of Leeds University for facilities for that and many other meetings of the Association was carried on the motion of Mr. A. W. ELLIOTT (Elland), seconded by Mr. J. W. CARLTON (Shipley).

Mr. H. J. HODSMAN, M.Sc., Lecturer in Gas Chemistry at the University, responded, and expressed the regrets of Prof. Cobb being unable to be present that day.

THE CLAYTON AWARD.

The members subsequently adjourned for tea at the Griffin Hotel, followed by a smoking concert, during which Mr. L. Hartley, of Messrs. Clayton, Son, & Co., Gas Constructional Engineers, Leeds, presented the Clayton Award for the best paper of the 1932 session in the Yorkshire Junior Gas Association, to Mr. B. Thorpe, the newly-elected President.

Preparation of Coke for the Market*

By H. SINGLETON, M.Inst.Mech.E., Engineer and General Manager of the Huddersfield Corporation Gas Department.

I do not apologize for introducing the subject of coke to your special notice to-day in view of the keen competition existing for coke sales, and particularly the efforts being made by the oven coke producers to capture what was once our entire market. There is also another reason for the introduction of this subject in the large stocks of coke existing both in this country and on the Continent. I often hear remarks to the effect that if coke producers would screen their coke properly there would be no difficulty in selling it. I am afraid that I must disagree, for if this were so, 90% of the coke produced would find a market quickly. Very few works to-day do not screen; on the other hand almost all plants are now so arranged that the coke produced must automatically pass over screens on its way to storage hoppers or storage ground. Much more, therefore, than merely screening or grading coke is required to produce a coke demand.

This leads me to consideration of what is required to market coke and keep up its reputation. Most works can produce good salable coke. In order to attain this end the first consideration is, of course, the choice of coals. Coal must not only be bought for its gas-making qualities, but more than ever before from the standpoint of its coke-making qualities also. I shall, however, confine my remarks entirely to its coke-making qualities. We hear a good deal about coal-blending, and this may be studied from three standpoints—*i.e.:*

1. Blending of coals which are wholly coking coals.
2. Blending of coking and non-coking coals.
3. Blending of coking coals with coke breeze.

Each of these methods of blending coals has for its object the increasing of the combustibility of the coke, more particularly for use in open grates. It is my firm belief that it is not necessary to resort to what is termed low-temperature carbonization to produce a fuel which will burn well in open grates. A few years ago we produced a variety of low-temperature cokes which were very desirable fuel for an open grate, but the cost was prohibitive when com-

* Paper before the Yorkshire Junior Gas Association, Oct. 28, 1933.

pared with the price of good gas coke. Mr. John Roberts and Mr. G. M. Gill are working on coal-blending by intimately mixing coking with non-coking coals to produce a coke which can be lighted and burned in an open grate as easily as coal; they are, however, not working at any lower temperatures than present-day gas-making temperatures. It has been proved that coke which has been " stewed " or left in the retorts after gas-making has ceased is much more difficult to ignite. On the other hand the question of the strength of coke must not be overlooked by producing incompletely carbonized coke; for with modern mechanical handling a large unprofitable amount of breeze is produced with soft friable coke. The type of handling plant irrespective of coke strength plays a large part in breeze production. I have known cases of changes in coke handling plant which have varied the breeze production by 5% by weight of the coal carbonized.

Importance of Clean Coal.

Too much emphasis cannot be given to the importance of securing coals low in ash, or perhaps it would be more accurate to say coals which have been well cleaned. A well cleaned coal may still contain ash in a finely distributed state throughout the coal. But I would much prefer a coal with 5% of finely divided and well distributed ash than a coal with the same total amount of ash in the form of bats or scales. My reason for this is that the finely divided ash on combustion of the coke will fall through the grate bars, whereas the larger bats or scales collect on the grate bars and fuse into clinkers, which are troublesome to remove. The ashes should also be analyzed and tested for their fusion temperature, so that where possible coals having high ash fusion temperatures only should be secured.

I next come to the quenching of the coke; this operation, of course, does not occur where continuous vertical retorts are in use, but it is a very troublesome question with all other forms of carbonizing plant. Apart from the Sulzer cooling process and the Liverpool process there appear to be three general methods of coke quenching—namely:

Bench quenching, where the coke is spread on an inclined bench to quench and cool.

Skip or wagon quenching, where a skip or wagon of hot coke is quenched by immersion in a tank of water, or is placed under a quenching tower and quenched by means of powerful sprays.

Conveyor quenching, where the coke is passed under fixed sprays or automatically operates sprays as it travels along.

Now the first two methods are left to the judgment of the attendant as far as duration of quenching or quantity of water is concerned, so that the coke may be over or under quenched; but one would suggest more often over-quenched on account of the fear of having a fire in the storage hoppers. The conveyor method gives perhaps more regular treatment to the coke, but here the correct quenching of the large coke leads to over-quenching of the small coke.

Having these results in mind we decided to make a number of tests on the possibilities of drying smaller sizes of coke. The first test was to imitate the bench method of quenching, and therefore a quantity of large coke, which had been carefully hand-quenched so that it would retain a considerable amount of heat though safely quenched, was placed on a brick-paved floor, and 20% of over-quenched coke nuts was distributed among this hot coke and allowed to remain in contact with it for half an hour. The moisture content of these coke nuts before the test was 24·1% and after half an hour's contact with the large coke the moisture content of the nuts was 15·9%. This demonstrated that the practice of lightly quenching large coke on a bench has a beneficial effect on the small sizes of coke, and that if coke nuts with a smaller initial moisture content had been used in this test the moisture remaining in them at the end of the test would be quite satisfactory.

The next test was to imitate the conditions which would obtain when coke is stored in the hopper just as produced—namely, before screening. It was thought that the surplus heat in the lightly quenched large coke in the hopper would assist in the drying-off of the smaller sizes. A steel hopper was therefore provided and filled with a mixture of lightly quenched large coke and 20% of over-quenched coke nuts of a known moisture content. The hopper was filled with alternate layers of large hot coke and of coke nuts until it was full. The proportion of nuts to large coke was in the proportion relative to that produced in horizontal carbonizing practice. The percentage of moisture in the over-quenched nuts was 25·4% in this case, and after remaining in the hopper for one hour in contact with the lightly quenched coke it was reduced to 20·8%.

It will be noticed that the reduction in moisture on this method is not so great as that obtaining on the bench quenching. This is no doubt due to the fact that the moisture is not removed from the hopper by the atmosphere so quickly as it is in the bench quenching, which allows of a free air circulation.

Future Experiments.

These tests, while they may be considered crude, were certainly interesting, and gave us ideas on which to base our future experiments. A number of methods were then considered which would have been more or less successful, but the process which appealed to me most was one which completely dried the coke, every size having no more moisture in it than coke produced in continuous verticals. This brought us to our next test, which I am convinced is the solution to the possibility of selling dry coke.

The apparatus which was provided for this test was a sheet iron hopper 2 ft. 6 in. deep by 2 ft. diameter with a 3 in. inlet at the base and a 6 in. outlet in the lid, which was loosely fitting at the top. A grid was provided over the inlet pipe to support the coke and distribute the hot gases. A pipe was then laid from the base to a fan which was connected to the main flue of the setting, and hot waste gases were forced through the hopper. Test cocks, thermometers, and pyrometers were fixed at vantage points for the purpose of collecting information. Each graded size of coke was taken and tested as follows:

Moisture content test of coke was taken before and after the drying. Sulphur content of the flue gas before entering the hopper. Temperature of the flue gases. Sulphur content of the coke before and after drying, and the speed of the flue gases through the hopper.

The weight of coke in the hopper was 2 cwt. on each test. The following table shows the results obtained.

Coke Quality.

——	Large.	Broken.	Nuts.	Broken.	Nuts.
Weight of charge, cwt.	2	2	2	2	2
Period of blow	½-hour	½-hour	½-hour	5-hours	4-hours
Velocity of flow of flue gases, feet per minute	318	300	265	278	271
Volume of flow, c.ft. per minute	62·7	59·2	52·2	54·9	53·4
Total amount of waste gas passed	1881	1776	1566	16,470	12,816
Analysis of waste gas from main flue —					
CO_2, %	average of twelve tests		9·1		
O_2, %			11·4		
CO, %			0·0		
Average temperature in main flue, °C.	363	359	361	368	365
Analysis of waste gas at hopper inlet —					
CO_2, %	average of twelve tests		7·9		
O_2, %			12·7		
CO, %			0·0		
Average temperature of gases entering hopper, °C.	310	295	305	320	315
Sulphur dioxide content of waste gases entering hopper	average of eight tests		0·03 grammes per c.ft.		
Moisture —					
Before drying, %	0·80	13·30	15·50	13·20	21·00
After drying, %	0·30	6·00	12·80	0·00	0·10
Sulphur—					
Before drying, %	1·92	1·096	..	1·56	..
After drying, %	1·37	1·023	..	1·29	..

It will be noticed that the first three tests were of half-an-hour duration each, and the fourth and fifth were of 5-hours and 4-hours respectively. The temperature of the waste gases entering the hopper can be reduced by lengthening the delivery pipe or by by-passing a portion of gases to atmosphere and thereby reducing the speed; or the delivery pipe may be lagged to conserve heat if too much is being lost *en route* to the hopper. By sealing up the sight plugs on the settings a higher CO_2 content could be obtained which even with the resultant higher temperature would reduce any possibility of fire in the hopper. It is interesting to note the reduction of the sulphur in the coke after heating. The dried cokes burned extremely well in an open grate. These tests are, of course, only the preliminary ones, and further tests are being carried out. The practical application of this method to coke hoppers and storage grounds has been provisionally protected.

The question of screening and de-breezing becomes a very simple operation if the coke is perfectly dry, and all will admit the advantage of being able to deliver to the consumer a dustless coke. A great saving would be made in the preparation of washed coke if a perfectly dry coke

was delivered to the washery, the apparent specific gravity being reduced.

I have been studying the possibilities of dry cleaning coke, and am convinced that apparatus could be produced in order that dry breeze could be supplied for blacksmith's forges, &c.

Systematic Hawking.

With respect to local sales, I am sure that a large additional quantity of coke could be disposed of by many works if a systematic hawking of bagged coke was practised, particularly if the coke is supplied perfectly dry and clean. Coke of this nature will burn easily in an ordinary grate, and where any difficulty exists a small proportion of coal slack will put the matter right. Special coke grates are now on the market in which graded gas coke burns very well.

The sale of coke in penny paper bags was carried out in Huddersfield before the war, but the cost of the paper bags together with filling proved very uneconomical. In Halifax, however, a success is made of selling coke in 3d. paper bags to-day.

Haphazard grading of coke is useless; the needs of the particular locality must be carefully considered before fixing the sizes into which coke is to be graded. If the sale of coke for steam raising is your objective then experiments are necessary before deciding what is the most economical size to produce or supply. If on the other hand coke is to be used in central heating boilers quite different conditions are found, and hence a different size may be more economical. Assistance should be given to customers in demonstrating the best draught and firing conditions.

More than ever before is it necessary to have good salesmanship for coke. For one reason coke is more difficult to sell to-day than ever—partly because it has more competition (we even compete with it ourselves with our main product—gas), and partly because our competitors each employ live salesmen who call on and pester every possible customer. Indeed, they do far more than seek orders; they are most unscrupulous in their denunciation of gas coke, and this is one reason why it is necessary for a gas undertaking to have a salesman to call regularly and interview customers and to refute any wrong impressions which he finds. It cannot be too strongly emphasized that it is just as necessary to keep in contact with your coke customers as it is with gas customers.

The last, but not least, point in competition, of course, is price.

Many gas undertakings to-day have, in my opinion, placed too high a value on their coke. If coke is to be sold freely in any particular locality in which it is produced, it must compete on a calorific value basis with furnace coke. It has, of course, also to compete with fuel oil, but this competition introduces other factors, such as labour-saving, cleanliness, ash removal, stoking, capital cost of installation, electric current, and maintenance charges, stoppages, &c. One factor which has more particular local application, is the competition that coke experiences in Yorkshire from small coal. Small coal can be purchased very cheaply, and there is no doubt that, if it were not for the proximity of collieries to the large industrial centres of Yorkshire, a great deal more coke would be consumed, which would be greatly to the benefit of the town atmosphere.

Register of Patents

Ammonia Recovery.—No. 393,678.

Institution of Gas Engineers and Key, A., both of Westminster, S.W. 1.

No. 35,736; Dec. 24, 1931.

Several attempts have been made to recover the ammonia from the crude gas from carbonizing retorts or ovens, without use of sulphuric acid. The process of this invention utilizes the carbon dioxide in the crude gas for separating the ammonia in the form of ammonium bicarbonate or ammonium chloride.

When crude coal gas is passed through a saturated solution of ammonium bicarbonate, further formation of the bicarbonate and consequent separation of crystals of this compound will occur only if the gas introduced into the solution contains quantities of ammonia and carbon dioxide, such that when multiplied together the product exceeds a certain value. This value is dependent on temperature; at 20° C. it may be defined by saying that the percentage by volume of carbon dioxide in the gas multiplied by the grains of ammonia per 100 c.ft. of the gas must exceed 984.

The crude gas from carbonizing retorts or ovens does not contain the necessary quantities of carbon dioxide and ammonia to fulfil the condition explained above. This invention has as an object the re-distribution of the ammonia in the gaseous products of the carbonization of a particular coal so that there may occur an enhanced concentration of the ammonia in one portion of the gas at the expense of the ammonia in another portion, whereby from the enriched portion ammonium bicarbonate may be removed in the form of a solid.

One method of re-distributing the ammonia consists in causing the crude gas to flow in two streams, from one of which the ammonia is removed to be introduced into the other; this latter stream, enriched in ammonia, is passed through a saturated solution of ammonium bicarbonate and subsequently joins the first stream.

The fraction of the total quantity of gas represented by each stream is determined by the content of ammonia and carbon dioxide in the gas and is based on the consideration explained above, bearing in mind that it is economical to use the carbon dioxide in the gas to remove as much ammonia as is practicable under the prevailing conditions and to leave as little as may be of ammonia and carbon dioxide in this gas.

It will be found in the case of crude gas, from vertical retorts, at 20° C. and normal pressure, containing on the average 4% by volume of carbon dioxide and 200 grains of ammonia per 100 c.ft., one stream should contain about one-third of the total gas, and it is to this smaller stream that the ammonia contained in the other stream should be added. For this purpose the division of the gas stream is made preferably between the condensers and the washers, about two-thirds being passed directly to the washers and scrubbers as usual, and the remainder being preferably subjected to an efficient tar extractor.

The liquor from the condenser and scrubbers is worked up in known manner to obtain the whole or the greater part of the ammonia in admixture with steam, carbon dioxide, hydrogen, sulphide, and hydrogen cyanide as a gas leaving a still. This gas passes through a condenser, and thus cooled, but still containing some steam, passes into the smaller stream of gas from which tar has preferably been removed. This smaller stream then passes through an absorber containing a saturated solution of ammonium bicarbonate; in this absorber crystals of the bicarbonate are produced and are removed in any known manner. The gases leaving this absorber may be separately washed to recover the ammonia which has not been separated as bicarbonate, and then passed into the main stream of gas after the washers and scrubbers, or they may pass directly from the ammonium bicarbonate absorber to the main stream before the latter enters the washers and scrubbers. In either case the ammonia washed from the gases may be returned to the ammonia still.

If the absorber contains sodium chloride in place of, or as well as, ammonium bicarbonate, sodium bicarbonate will separate and ammonium chloride will accumulate. The contents of the absorber may then be filtered and the sodium bicarbonate worked up as a finished product; the filtrate may be boiled to expel ammonia and carbon dioxide (to be returned to the crude gas), and to leave a solution containing ammonium chloride and sodium chloride, which may be worked up in known manner to recover the ammonium chloride.

Another method of re-distributing the ammonia consists in operating intermittently. A third method consists in carbonizing the coal in two installations.

Gas Acts (1920 and 1929) Orders.

ORDERS UNDER SECTION 1.

St. Ives (Hunts.) Gas.

To authorize the Company to raise, at any time during the period of three years after the date on which the Order comes into operation, additional share capital of an amount not exceeding £15,000.

Slough Gas.

To authorize the Company to raise further additional capital not exceeding £100,000 by the creation and issue of ordinary or preference stock.

SPECIAL ORDER.

Oldbury Urban District Council.

To empower the Council to purchase by agreement, and to provide for the sale and transfer to and vesting in the Council of, so much of the undertaking of the Rowley Regis and Blackheath Gas Company as is situate in or relates to that part of the Urban District of Oldbury which is described upon such terms as have been agreed upon or as may be specified in the Order.

GAS MARKETS & MANUFACTURES

Stock Market Report.

[For Stock and Share List, see later page.]

The wild fluctuations in the American dollar again dominated markets for the greater part of last week, and, with investors marking time, business was dull and prices sagged, particularly in the gilt-edged section. A change for the better was discernible on Friday, however, following a recovery in the dollar, and the position became more hopeful. Under the lead of gilt-edged stocks prices moved up, and the outlook for the current week appears encouraging.

An appreciable volume of business was transacted in the Gas Market, and prices, with a few important exceptions, were well maintained. In sympathy with other high-class stocks, Gas Light units suffered by reason of the depressed conditions, and the price fell 9d. to 27s., while Brighton 6% preference eased 4 to 137¼. The only other reactions of note occurred in the stocks of a few companies operating abroad, including European and Imperial Continental, which dropped 8 and 7 points respectively. On the other hand, the market was able to register a number of improvements. The list was headed by Winchester Water and Gas 5%, which was marked up 8 points to 117½. Lea Bridge hardened 3 to 172½, business being done at 175; South Metropolitan 6% preference, Commercial ordinary, and Alliance and Dublin ordinary all gained 2. On the Bristol Exchange Newport (Mon.) gained 1½, while several other stocks were 1 point higher.

A very satisfactory position is revealed by the report and accounts of the Oriental Gas Company for the year to June 30 last. The net profit has increased from £37,160 for 1931-32 to £42,732 and £10,000 (against *nil*) transferred to reserve. The usual interim dividend of 3½%, less tax, was paid in May last, and the Directors are recommending a final dividend of 4½%, free of tax (against 4½%, less tax). After providing for these items the carry-forward is increased from £87,893 to £96,625. The report states that the sales of gas increased 0·6% compared with the previous year, and the price was reduced as from March last. The Company's stock improved a further 2 points last week to 134½, which, at the time of writing, includes the full final dividend, and at this price the yield on the year's dividend works out at £7 1s. 8d.%.

Current Sales of Gas Products.

The London Market for Tar Products.

LONDON, *Nov.* 20.

The market for tar products remains practically unchanged. Current prices are as follows:

Pitch is about 75s. per ton f.o.b.

Creosote, 3d. to 3¼d. per gallon.

Refined tar, 4d. to 4¼d. per gallon in bulk at makers' works.

Pure toluole, about 3s. 8d.; pure benzole, 1s. 10d. to 1s. 11d.; 95/160 solvent naphtha, 1s. 8d. to 1s. 9d.; and 90/140 pyridine bases, about 5s.—all per gallon naked at makers' works.

Tar Products in the Provinces.

Nov. 20.

The average prices of gas-works products during the week were: Gas-works tar, 29s. to 34s. Pitch—East Coast, 70s. to 72s. 6d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 70s. to 72s. 6d.* Toluole, naked, North, 2s. 5d. to 2s. 6d. Coal-tar crude naphtha, in bulk, North, 6¼d. to 6¾d. Solvent naphtha, naked, North, 1s. 7¼d. to 1s. 7¾d. Heavy naphtha, North, 10¼d. to 11d. Creosote, *ex* works, in bulk, North, liquid and salty, 2d. to 2¼d.; low gravity, 2d.; Scotland, 2d. to 2¼d. Heavy oils, in bulk, North, 4d. to 4¼d. Carbolic acid, 60's, 2s. 5d. to 2s. 6d. Naphthalene, £9 10s. to £10 10s. Salts, 55s. to 75s., bags included. Anthracene, "A" quality, 2½d. to 3d. per minimum 40%, purely nominal; "B" quality, unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *Nov.* 18.

Inquiries are more numerous, but, on the whole, supplies for prompt delivery are scarce in this district. New business is, therefore, difficult.

Crude gas-works tar.—The actual value is 40s. to 42s. per ton *ex* works.

Pitch.—Export price is nominal at round 67s. 6d. per ton f.o.b. Glasgow. Home price is 62s. 6d. to 67s. 6d. per ton *ex* works in bulk.

Refined tar to Ministry of Transport Specification is still quoted at 3¼d. to 3⅜d. per gallon f.o.r. in buyers' packages.

Creosote oil.—Prompt supplies are difficult to secure, but prices are unchanged. B.E.S.A. Specification is 3⅛d. to 3⅜d. per gallon; low gravity, 3⅛d. to 3⅜d. per gallon; and neutral oil, 3¼d. to 3½d. per gallon—all in bulk *ex* works.

Cresylic acid.—Prices are now firmer in this area. Pale, 97/99%, is 1s. to 1s. 1d. per gallon; dark, 97/99%, 10d. to 11d. per gallon; and pale, 99/100%, 1s. 3d. to 1s. 4d. per gallon—all f.o.r. in buyers' packages.

Crude naphtha remains scarce at 4½d. to 5d. per gallon *ex* works in bulk, according to quality and quantity.

Solvent naphtha.—90/160 grade is 1s. 6d. to 1s. 7d. per gallon, and 90/190 heavy naphtha 1s. per gallon.

Motor benzole.—Price is nominal at 1s. 7d. per gallon *ex* works.

Pyridines.—90/160 grade is 3s. 3d. to 3s. 6d. per gallon, and 90/140 grade 3s. 6d. to 3s. 9d. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s. d.		s. d.	
Crude benzole	0 10	to	0 10¾	per gallon at works
Motor "	1 5	"	1 5½	" " "
Pure "	1 8½	"	1 9	" " "

Trade Notes.

New Holder for Glasgow.

The Glasgow Gas Committee have recommended the acceptance of a tender by Messrs. Clayton, Sons, & Co., of Leeds, amounting to £9224, for a new gasholder at the Dalmarnock Gas-Works.

Astrah Products.

We are advised that the stove cleaner and de-greasing compound manufactured by Messrs. Astrah Products is in future being marketed under the name of "Fairfield-Kleener." The nature of the cleaner has in no way been altered—remaining non-caustic and non-injurious.

"Koh-i-Noor" Pencils.

The firm of L. & C. Hardtmuth, who make the Koh-i-Noor pencil, are building a factory in England. British labour and British material will be used as far as it is possible to use them. Unfortunately, it is not possible to make the finest quality of "lead" for pencils in this country, and the leads will therefore continue to be made in Czecho-Slovakia.

Cast-Iron Gland Cocks for all Purposes.

Heavy type cast-iron gland cocks especially applicable to a wide variety of gas-works purposes are manufactured by Haughton's Patent Metallic Packing Company, Ltd., of 30, St. Mary-at-Hill, London, E.C. 4. All sizes of these cocks, for steam, water, gas, oils, tar, ammoniacal liquor, &c., are kept in stock to facilitate prompt attention to all orders, while gun-metal plugs can be fitted and flanges faced. The firm supply, in addition, cast-iron fullway valves, tested to 300 lbs. water pressure, which are suitable for dealing with gas-works steam, water, and liquors.

Contracts Advertised To-Day.

Compressor, &c.
Colwyn Bay Urban District Council. [p. 608.]

Gasholder and Tank.
Middlesbrough Gas Department. [p. 608.]

Portable Conveyor.
Warrington Gas Department. [p. 608.]

Reinforced Foundation.
Middlesbrough Gas Department. [p. 608.]

Station Meter.
Gainsborough Urban District Council. [p. 608.]

STOCK AND SHARE LIST.

Official Quotations on the London and Provincial Stock Exchanges.

Issue £	Share.	When ex-Dividend.	Dividends. Prev. Hf.-Yr. % p.a.	Dividends. Last Hf.-Yr. % p.a.	NAME.	Quotations. Nov. 18. (Provincial Exchanges Nov. 17.)	Rise or Fall on Week	Transactions. Lowest and Highest Prices During the Week.
1,551,868	Stk.	Oct. 9	7	7	Alliance & Dublin Ord. ...	122—132	+2	...
374,000	,,	July 10	4	4	Do. 4 p.c. Deb. ...	85—95	...	...
557,655	,,	Aug. 28	7	7	Barnet Ord. 7 p.c.	165—170	...	...
300,000	1	Oct. 23	1/9⅓	1/4⅔	Bombay, Ltd.	26/-—28/-	...	27/-—27/4⅔
178,280	Stk.	Aug. 14	9½	9½	Bournemouth sliding scale	192—202	...	...
550,050	,,	,,	7	7	Do. 7 p.c. max. ...	163—168	...	165
439,160	,,	,,	6	6	Do. 6 p.c. Pref. ...	135—140	...	138—138½
50,000	,,	June 26	3	3	Do. 3 p.c. Deb. ...	75—80	...	...
162,025	,,	,,	4	4	Do. 4 p.c. Deb. ...	102—107	...	105¼
210,000	,,	,,	5	5	Do. 5 p.c. Deb. ...	120—125	...	...
357,900	,,	Aug. 28	7½	7½	Brighton, &c. 6 p.c. Con. ...	160—170	...	...
540,000	,,	,,	6¾	6¾	Do. 5 p.c. Con. ...	144—149	...	148
195,500	,,	,,	6	6	Do. 6 p.c. B Pref.	135—140	—4	136 138
1,487,500	,,	July 24	5	5	Bristol 5 p.c. max.	113—114*a*	+½	...
120,420	,,	June 26	4	4	Do. 1st 4 p.c. Deb. ...	99—101*a*	...	...
217,870	,,	,,	4	4	Do. 2nd 4 p.c. Deb. ...	99—100*a*	...	...
328,790	,,	,,	5	5	Do. 5 p.c. Deb.	121—123*a*	...	...
855,000	,,	Sept. 25	8	7	British Ord.	159—164	...	156½—160
100,000	,,	June 26	7	7	Do. 7 p.c. Pref.	147—152	...	...
350,000	,,	,,	5½	5½	Do. 5½ p.c. Pref. ...	108—113	...	...
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	94—99	...	...
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb. ..	103—113	...	...
160,000	,,	June 26	5	5	Cambridge 5 p.c. Deb. ...	115—120	...	...
100,000	10	May 22	6	4	Cape Town, Ltd.	7—8	...	...
100,000	10	Nov. 6	4½	4½	Do. 4½ p.c. Pref. ...	6⅞—7¾*	...	...
150,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. ...	95—100	...	...
626,860	,,	July 24	6	6	Cardiff Con. Ord.	117—122	...	...
237,860	,,	June 26	5	5	Do. 5 p.c. Red. Deb.	105—110	...	...
157,150	,,	Aug. 14	6½	5	Chester 5 p.c. Ord.	105—110‖	...	...
98,936	1	Oct. 9	2/-	2/-	Colombo, Ltd. Ord.... ...	1⅞—1⅞	...	...
24,500	1	,,	1/4⅜	1/4⅜	Do. 7 p.c. Pref. ...	18/6—20/6	...	...
609,204	1	Oct. 9	/11'48	/11'48	Colonial Gas Assn. Ltd. Ord.	1⅛—1⅛	...	...
296,053	1	,,	1/3'30	1/3'30	Do. 8 p.c. Pref.	23/-—25/-	...	24/14—24/6
1,796,955	Stk.	July 24	6½	5	Commercial Ord.	122—127	+2	123—124
475,000	,,	June 12	3	3	Do. 3 p.c. Deb. ...	75—80	...	78
265,272	,,	Mar. 6	—	5	Do. 5 p.c. Deb. ...	120—125	...	...
807,560	,,	Aug. 14	7	7	Croydon sliding scale	147—152	...	151½—152
469,590	,,	,,	5	5	Do. max. div. ...	105—110	...	...
500,000	,,	July 10	5	5	Do. 5 p.c. Deb.	120—125	...	...
542,270	,,	Mar. 6	7	10	Derby Con.	170—180*c*	...	...
55,000	,,	July 10	4	4	Do. 4 p.c. Deb.	93—98*c*	...	...
209,000	,,	Aug. 28	5	5	East Hull Ord. 5 p.c.	108—113	...	...
179,500	,,	Aug. 28	6	6	East Surrey Ord. 5 p.c.	127—132	...	...
155,019	,,	June 26	5	5	Do. 5 p.c. Deb. ...	117—123	...	...
1,002,180	,,	Sept 25	17	15	European, Ltd.	120—130	—8	126—130
19,378,992	,,	Aug. 14	5⅝	5⅝	Gas Light & Coke 4 p.c. Ord.	26/6—27/6/	—/9	26/9—27/10/
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	86—89	...	87¾—89
4,477,106	,,	,,	4	4	Do. 4 p.c. Con. Pref. ..	102—105	...	103—104½
6,102,497	,,	June 12	3	3	Do. 3 p.c. Con. Deb. ..	82—85	+1	83—84
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. ..	115—118	...	116¼—117½
3,500,000	,,	,,	4½	4½	Do. 4½ p.c. Red. Deb. ..	112—116	...	114—114½
270,466	,,	Aug. 28	6	6	Harrogate New Cons. ..	120—125	...	...
82,500	,,	Aug. 28	7	7	Hastings & St. L. 5 p.c. Conv	143—148	...	149½
258,740	,,	,,	5½	5½	Do. 5½ p.c. Conv	111—116	...	115—116
140,000	1	Oct. 9	1/10	1/7½	Hongkong & China, Ltd. ...	31/-—33/-	...	31/-
218,200	Stk.	Aug. 14	6	6	Hornsey Con. 3½ p.c. ...	120—125	...	...
5,600,000	,,	Nov. 6	14	10	Imperial Continental Cap.	198—203*	—7	192—202
223,150	,,	Aug. 14	3½	3½	Do. 3½ p.c. Red. Deb.	90—95	...	...
235,242	,,	Aug. 14	8½	8½	Lea Bridge 5 p.c. Ord. ...	170—175	+3	170—175
2,145,907	,,	Aug. 14	6	6	Liverpool 5 p.c. Ord. ...	120—122‖	...	...
245,500	,,	June 26	5	5	Do. 5 p.c. Red. Pref. ..	103—113‖	...	...
306,083	,,	July 17	4	4	Do. 4 p.c. Deb. ...	99¼—101¼‖	...	...
165,736	,,	Aug. 28	10	8	Maidstone 5 p.c. Cap. ...	180—190	...	...
56,176	,,	July 10	3	3	Do. 3 p.c. Deb. ...	69—74	...	...
75,000	5	June 12	110	110	Malta & Mediterranean ...	9—11	...	...
392,000	—	Oct. 2	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	98—103	...	...
231,978	Stk.	Aug. 28	5	5	M. S. Utility "C." Cons. ...	111—116	...	...
818,657	,,	,,	4	4	Do. 4 p.c. Cons. Pref.	93—97	...	...
112,126	,,	June 26	4	4	Do. 4 p.c. Deb. ...	100—105	...	105
148,955	,,	,,	5	5	Do. 5 p.c. Deb. ...	113—118	...	...
675,000	,,	21 May '31	16	16	Montevideo, Ltd.	60 70	—2	68
2,061,315	,,	Aug. 14	6½	6	Newcastle & Gateshead Con.	25/6—26/3*d*	...	...
682,856	,,	,,	4	4	Do. 4 p.c. Pref. ...	100—102*d*	...	...
776,706	,,	July 10	3½	3½	Do. 3½ p.c. Deb. ...	92—94*d*	+1	...
277,285	,,	May 8	5	5	Do. 5 p.c. Deb. '48...	107—109*d*	...	...
274,000	,,	Aug. 14	5	5	Newport (Mon.) 5 p.c. max.	101—104*a*	+1½	...
204,940	,,	Aug. 28	7½	7½	North Middlesex 5 p.c. Con	153—158	...	...
396,160	,,	Aug. 14	5	5	Northampton 5 p.c. max. ...	101—106	...	...
300,000	,,	Apl. 24	9	7	Oriental, Ltd.	132 137	+2	134—136
316,617	,,	June 26	8	6	Plym'th & Stonehouse 5 p.c.	167 172	...	167½
504,416	,,	Aug. 28	6	6	Portsm'th Con. Stk. 4 p.c. Std	162 167	...	...
241,446	,,	,,	5	5	Do. 5 p.c. max. ...	102 107	...	...
114,000	,,	Aug. 14	5	5	Preston 5 p.c. Pref. ...	101—106	...	...
686,312	,,	July 24	4	4	Primitiva 4 p.c. Rd. Db. 1911	83—93	...	...
389,813	,,	June 26	4	4	Do. 4 p.c. Cons. Deb.	88 93	...	...
150,000	10	Sept. 25	6	6	San Paulo 6 p.c. Pref. ...	6½ 7½	...	...
1,736,968	Stk.	Sept. 11	6	6	Sheffield Cons.	134—136*e*	...	...
95,000	,,	July 10	4	4	Do. 4 p.c. Deb.	90 94*e*	...	...
133,201	,,	Sept 11	5	5½	Shrewsbury 5 p.c. Ord. ...	132—137	...	...
90,000	10	June 12	15	14	South African	3—5	...	...
6,709,895	Stk.	Aug. 14	7	5	South Met. Ord.	133—136	...	134—136½
1,135,812	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	137—142	+1	137—141
850,000	,,	,,	20/-*g*	4	Do. 4 p.c. Irred. Pf.	102—105	+1	102½—103¾
1,895,445	,,	July 10	8	3	Do. 3 p.c. Deb. ...	80—83	...	81¾—82½
1,000,000	,,	July 24	5	5	Do. 5 p.c. Red. Deb	112—116	...	113½—116
209,820	,,	Aug. 14	8½	8½	South Shields Con.	72 -174*d*	+1	...
1,543,795	,,	Aug. 14	6	6	South Suburban Ord. 5 p.c.	131—136	...	131—135¾
300,000	,,	,,	5	5	Do. 5 p.c. Pref.	113—118	+1	115¾—116½
300,000	,,	,,	—	4	Do. 4 p.c. Pref.	100—103	...	102½—103¾
868,837	,,	June 26	5	5	Do. 5 p.c. Deb.	119—124	...	119—123
100,000	,,	,,	—	—	Do. 4 p.c. Deb.	102—105	...	...
647,740	,,	Aug. 28	5	5	Southampt'n Ord. 5 p.c. max.	107—112	...	111—112
121,275	,,	June 26	4	4	Do. 4 p.c. Deb.	99—104	...	...
350,000	,,	Aug. 28	5¼	5¼	Swansea 5¼ p.c. Red. Pref.	107—111	...	...
200,000	,,	June 26	6¼	6¼	Do. 6¼ p.c. Red. Deb.	103—108	...	...
1,076,490	,,	Aug. 14	6½	6½	Tottenham and District Ord.	148—153	...	150½—152
300,000	,,	,,	5¼	5¼	Do. 5¼ p.c. Pref. ...	124—129	...	...
62,285	,,	,,	5	5	Do. 5 p.c. Pref. ...	112—117	...	...
199,005	,,	June 12	4	4	Do. 4 p.c. Deb. ...	98—103	...	...
85,701	,,	Oct. 9	6	6	Tuscan, Ltd., 6 p.c. Red. Db.	90—100	...	...
347,769	,,	Aug. 28	7	7	Uxbridge, &c., 5 p.c. ...	144—149	...	...
88,330	,,	,,	5	5	Do. 5 p.c. Pref. ...	112 117	...	...
1,322,220	,,	July 10	7	7	Wandsworth Consolidated	153—158	...	156—158
1,096,373	,,	,,	5	5	Do. 5 p.c. Pref.	117—122	...	121
1,317,964	,,	June 26	5	5	Do. 5 p.c. Deb.	118—123	...	122½
158,400	,,	Aug. 28	6⅛	5	Winchester W. & G. 5 p.c. Con.	115—120	+8	...

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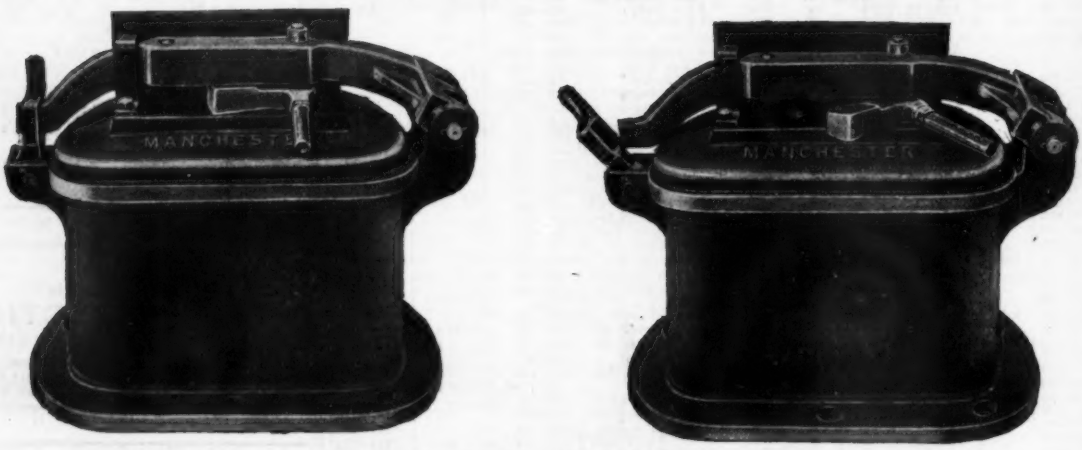

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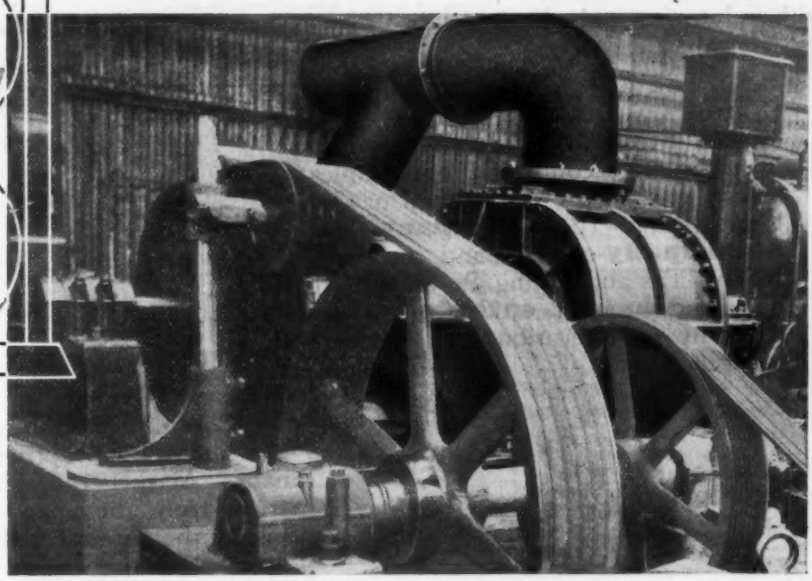

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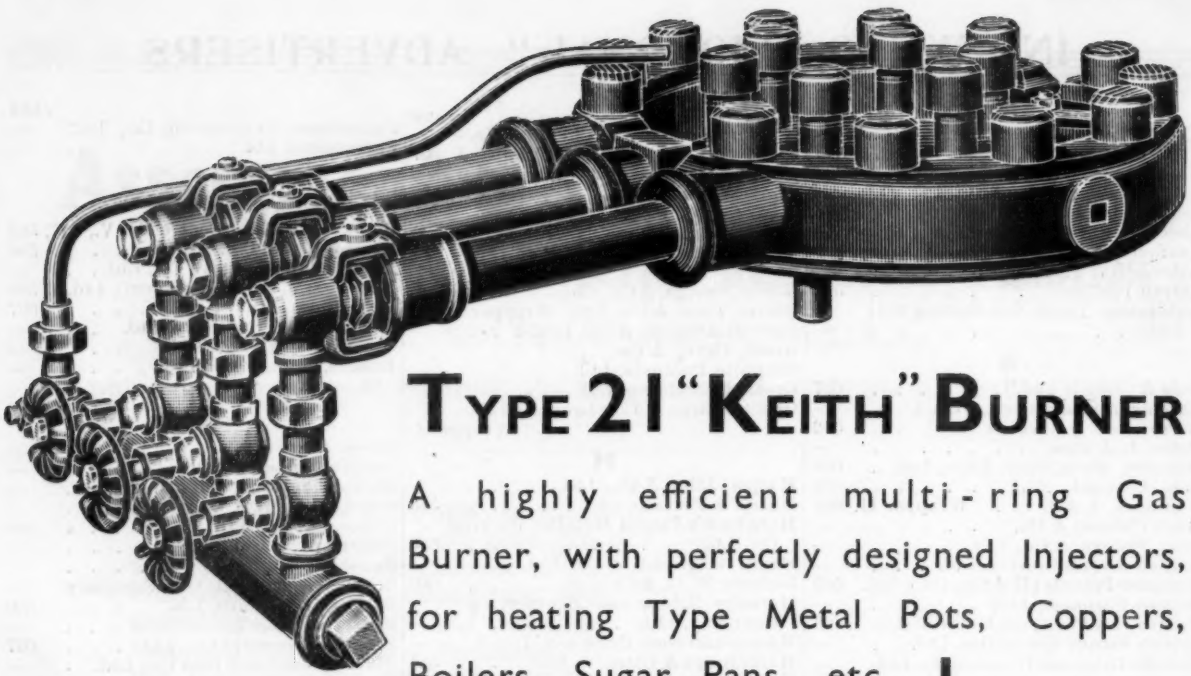

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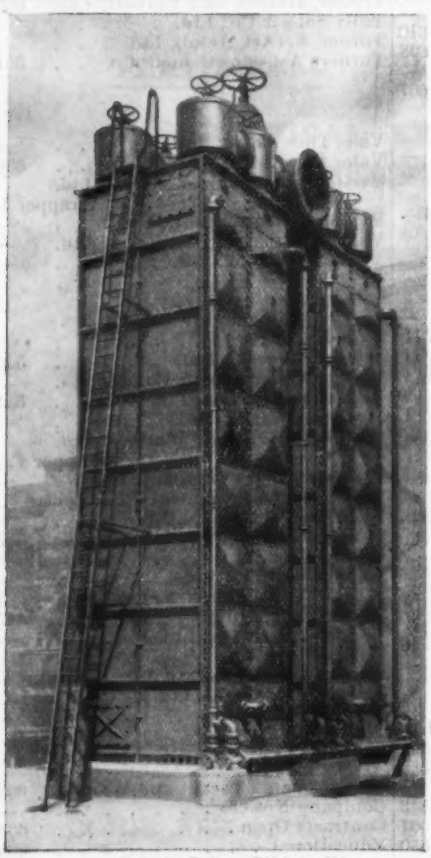

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